APRIL 1958

This is YOU! Page 11

How Not to Catch Fish Page 14

POWER INDUSTRY

President **ROBERT S. STEVENSON**
of **ALLIS-CHALMERS**

'Safety for safety's sake can stand on its own two feet . . .'

page 12

$1.00 the copy

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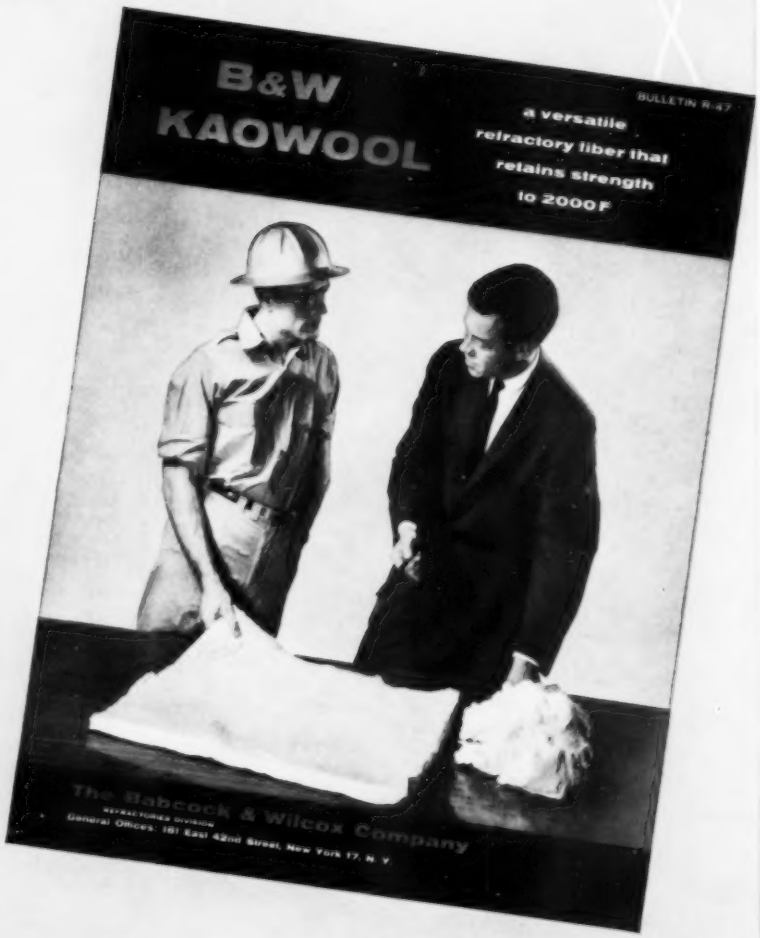
New Bulletin on

B&W KAOWOOL

Gives data on many uses of 2000 F refractory ceramic fiber

B&W Kaowool is widely used in many power plant applications. It is excellent for packing expansion joints in refractory linings as well as around headers and burner boxes. Kaowool has proved its long life when applied around inlet valves of turbo generators and the flange covers of steam turbines. Write for new bulletin giving helpful data on B&W Kaowool, the easy-to-apply ceramic fiber that withstands temperatures to 2000 F.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Circle 1654 opposite last page

CONVENTIONS and EXHIBITS

April 1-3: ASME Conference on Instruments and Regulators, University of Delaware, Newark, Del.

April 9-10: ASME Railroad Division Conference; Statler Hotel, Cleveland.

April 14-15: ASME Maintenance and Plant Engineering Conference; Penn-Sheraton, Pittsburgh.

April 14-17: ASME Design Engineering Conference; International Amphitheatre, Chicago.

April 14-18: American Welding Society Annual Meeting and Show; Statler Hotel and Kiel Auditorium, St. Louis.

April 15-17: Joint Conference of ASME and AWS Metals Engineering Division; Statler Hotel, St. Louis.

April 19-25: Industrial Health Conference, Atlantic City.

April 20-23: AICE Annual Meeting; Sheraton-Mt. Royal Hotel, Montreal, Canada.

April 20-25: American Water Works Association; Dallas.

April 24-25: Joint Conference of ASME & SAM on Management; Statler Hotel, New York City.

May 1-8: ASTE Tool Show and Convention; Convention Center, Philadelphia.

May 4-7: Air Conditioning and Refrigeration Institute Annual Meeting; The Homestead, Hot Springs, Va.

May 5-7: American Mining Congress Coal Convention; Netherland Hilton Hotel, Cincinnati.

May 5-7: Purdue Industrial Waste Conference; Memorial Union Building, Lafayette, Ind.

May 7-11: Western Air Conditioning Industries Association Conference and Exhibit; Shrine Exposition Hall, Los Angeles.

May 14-16: Pacific Coast Electrical Association Annual Convention; Hotel Del Coronado, Coronado, Calif.

May 18-21: Industrial Heating Equipment Association Meeting; The Homestead, Hot Springs, Va.

May 19-23: AWS Show; Hotel Schroeder, Milwaukee. ◆

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NBP NATIONAL BUSINESS PUBLICATIONS, INC.

APRIL 1958

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IN THIS ISSUE

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The surprising findings of a survey of high shool students, this article summarizes what they think of engineers, scientists, and science.

12 **Safety . . . A Way of Life for Industry**

Allis-Chalmers President Robert S. Stevenson tells why safety deserves more than platitudes and lip-service. His article shows how it can pay off in dollars and cents as well as in other ways.

14 **How NOT to Catch a Fish**

If you're an angler you may find it hard to believe, but *not* catching fish in water intakes is sometimes as tough as catching them on one of your bad days. Research Associates' H. S. Burkley tells how not to do it.

18 **Inside ZETA**

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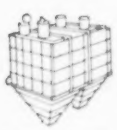

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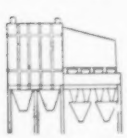

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DUST COLLECTION SYSTEMS

Circle 1655 opposite last page

REPORTS IN BRIEF

EE's will remain in short supply

This year's Edison Gold Medal award winner, John K. Hodnette, in his acceptance speech stated that he was shocked by statements in the press that the engineering shortage is over. Really creative engineers, he feels, will be always in demand.

The electrical industry, especially, offers a promising future to young engineers. "We are," he predicts, "far from reaching the saturation point of technical achievement."

Hodnette is an executive vice president of Westinghouse.

$1-million in seed money aids research projects

E. I. Green, Bell Telephone Laboratories vice president, reviewing Engineering Foundation's seed money plan to encourage engineering research, reports industry has raised $10 for every dollar EF has given. EF grants funds to a project in its early stages — until industry is willing to assume responsibility for seeing project through.

Receiving EF's helping hand over its 44 years were research projects on fatigue and diffusion of metals, properties of concrete, structural foundations, properties of steam and gas, heat transfer in fluids. Grants this year total $80,000, divided among 32 projects.

Engineers: too many, too few, mis-used?

Engineers' confusion over how they fit into the changing industrial scene increases with conflicting comments from various authorities. House Subcommittee on Manpower Utilization, headed by Rep. Davis of Georgia, blasts Federal agencies for creating artificial scarcity of engineers.

Defense effort, he feels, is being slowed down through poor management that misuses engineering skills.

West Coast engineers, already unhappy because demand there for engineers no longer exceeds the supply, have further cause for long faces. One leading aircraft manufacturer cut its allowance for engineers' merit raises from 2% of total engineering payroll to ½ of 1%.

Dr. John T. Rettaliata, Illinois Institute of Technology president, deplores widespread publicity on temporary shortage of engineering jobs. With the nation's security and economic growth more than ever dependent on top engineering talent, he feels that any factor discouraging prospective engineers could jeopardize country's welfare.

Hamilton Watch perfects time calibrating plan

Miniaturized, transistorized electronic frequency standard developed by Hamilton Watch Co.'s Instrument Division will aid development of highly accurate miniature timing systems.

Standard makes it possible to calibrate and divide time so precisely that it would take months to build up a timing error of one second. Essential component of the system is a miniaturized electronic tuning fork that withstands temperature and other variables.

The year ahead— boom or bust?

Westinghouse Electric Corp. reveals peak $2 billion sales in 1957, with hopes high for topping that figure in 1958. Steady growth of electrical industry and use of electric and electronic components for missiles are cited as business builders.

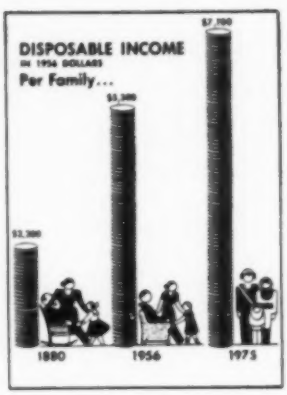
Orr & Sembower, Inc. upped 1957 sales 20% with its

package boilers, other preassembled industrial equipment. Edward Valves, Inc. anticipates new business from ship construction, automation in processing industries.

Commercial nuclear power, though, is bogged down because of high costs. Plastic building panels cause 20% sales rise at Filon Plastics Corp. during 1957, with hopes there for 25% increase in 1958.

Just around the corner — a rainbow in the sky?

Committee for Economic Development predicts that by 1975 this country can enjoy a utopia where average income after taxes will soar to $7100 a year.



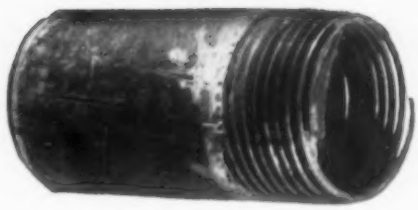
Average income now after taxes is $5300 per family.

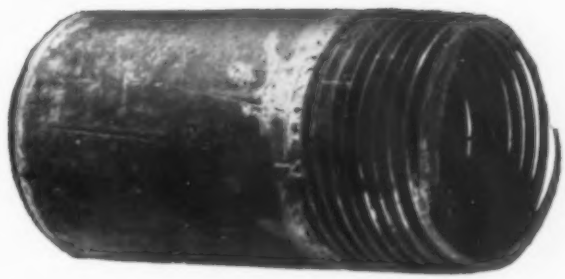
How to achieve this utopia? By an all-out effort by individuals and the government to make the most of all of our country's growth-producing potentials.

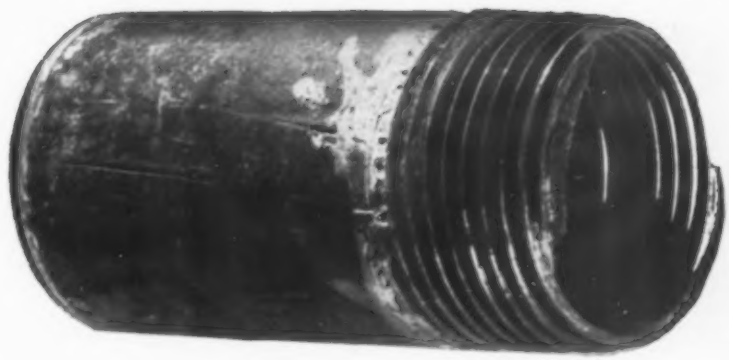
Design fire truck for mine hazards

Pittsburgh Consolidation Coal Co. and Mine Safety Appliances Co. have designed an underground fire truck to meet specific fire hazards encountered in mines.

Compact, low-slung, highly maneuverable truck (18 ft long, 7 ft wide, 50 inches high) can deliver 2100 gpm of water at high pressure. Nozzle projects over 100 feet without arcing — an important factor in low-roofed







● *Unretouched photos showing carbonic acid destruction typical of untreated pipelines.*

EASY TO SEE THROUGH – AFTER IT HAPPENS

It's too late for water treatment after the damage is done. Replacement of these threadbare nipples in the return line was only a matter of time. The grooving-type corrosive action of carbonic acid took care of that.

Destruction like this can be stopped with Dearborn Alkameen,* an amine in liquid form which dissolves in the condensate to neutralize the corrosive action of carbonic acid.

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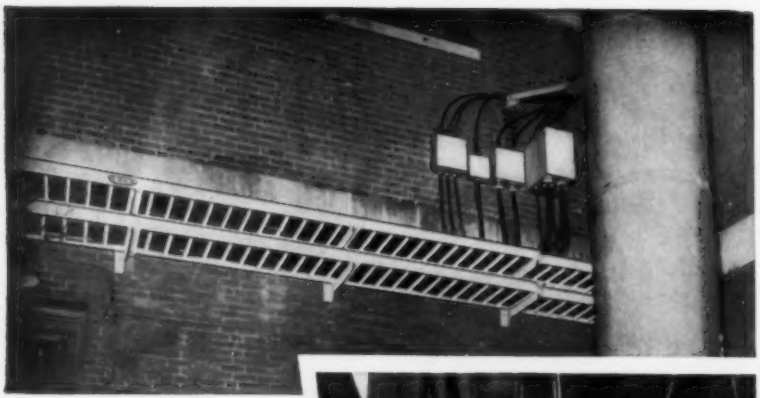

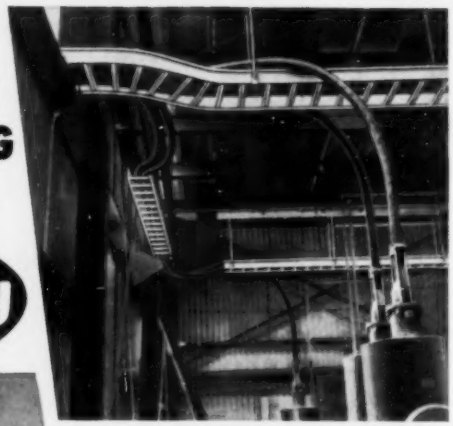

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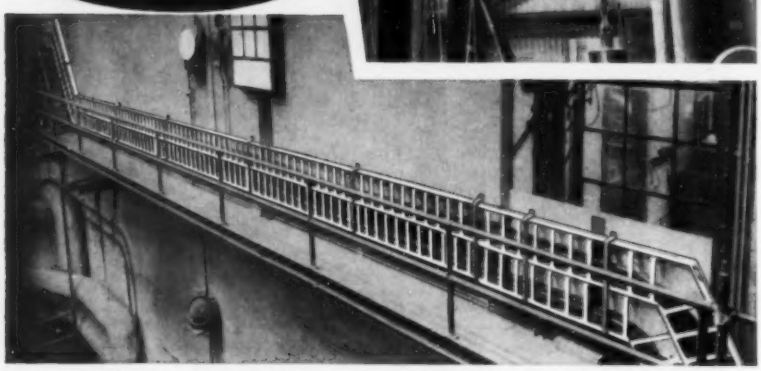

A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

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Circle 1657 opposite last page

REPORTS IN BRIEF

mines. Delivers fog or straight stream.

Fire engine and equipment are designed to be kept underground at all times. Hose is impervious to oil, acids, rot, and vermin. Can be put back on truck while wet.

Coal, wood combined give low-cost heat

A Florida chemical company gets most economical heat by firing coal with waste wood. Despite high freight cost of shipping coal to Florida, coal remains cheapest auxiliary fuel for this operation.

Experts suggest ways to cut utility bill

American Utility Cost Consultants, New York City, offers expert advice on cutting cost of purchased electricity and gas. Clients forward their monthly paid utility invoices to AUCC for checking accuracy and proper application of rate schedules. Clients' needs are analyzed to determine if changes in operating procedure would cut utility bills, and if client is taking advantage of best rate schedules.

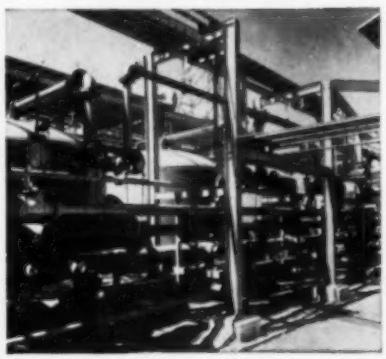
Coal freight costs may go higher

U. S. railroads are asking a freight rate increase on many commodities, including coal. Price hike would amount to 8c per ton on lake cargo, 10c per ton on freight north of the Ohio River.

TV goes where man fears to tread

Television is successfully keeping an eye on atomic energy operations in radioactive areas where no man can work unprotected, according to General Electric Co. Three-D color system at Idaho Falls, Idaho, aids in remote servicing of reactors used in devel-

ILLCO-WAY
ionXchange
filters



FOR PRODUCTION OF
ClearWater

In the design and manufacture of water-treating equipment, it often becomes necessary to include a filter of some type in the line-up in order to insure clarity and cleanliness of the water going to the next step. The picture above shows a large filter installation (in this case, at an outdoor location), one of many we have planned and produced to meet particular conditions or situations.

DIFFERENT TYPES
MANY APPLICATIONS

The filters we make may be any of the various types usually associated with the cleaning of water. Possible applications are numerous and may include such functions as removal of iron, rust, and manganese, removal of turbidity and suspended solids, clarification of lime-softened water, removal of free chlorine, organic matter, tastes, and odors, and various other special filtering requirements. *Whatever filters are needed in a water-treatment system, we are prepared to produce them.*

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Circle 1659 opposite last page

oping nuclear aircraft propulsion system.

At Hanford atomic plant, Richland, Wash., television examines rear face of operating nuclear reactor. TV reads instruments inside reactor enclosure at Vallecitos Atomic Laboratory, Pleasanton, Calif.

TV cameras are enclosed in housing for protection against radioactive dust and have special roentgen-resistant lenses.

AG&E considers name change

American Gas and Electric Co. president Philip Sporn reveals that a new corporate name will be up for consideration by shareowners at the annual meeting on April 30. New name: American Electric Power Co.

Since 1927 AG&E has been almost exclusively an electric company, according to Sporn.

Plate tin, lead at same time

New plating solutions developed by Dalic Metachemical Ltd. (Toronto) allow tin and lead to be plated singly or in combination in any proportion required by the user. High-lead-content alloys (93%) can be used for bearing applications; 60-40 tin-lead alloys are used for components that will be soldered. Plating solutions will not set up corrosion cells, will not cause embrittlement, and will not attack different neighboring metals.

Solve flyash problems by switching coals

An upstate New York utility reports successful solution of problems caused by flyash erosion. Better combustion is achieved with switch to spreader-stoker coal. Realignment of rear overfire-air jets and cinder returns also help. With excessive flyash eliminated, cause of erosion can't go up in smoke. ◆

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FASTER TUBE ROLLING with the new Airetrol Tube Expansion Control. Just set dial and torque sensing cam automatically stops expansion to .001" accuracy. Air-motor equipment and expansion tools for tubes ¼" to 1½". Electrically operated expansion control system for larger tubes.

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CUT TUBES QUICK AND EASY Cuts steel or non-ferrous tubes through tube sheets up to 4" thick. Positive feed control . . . no gouging or burning. Air or electric motor.

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You get pure condensate, an improved product; often make a profit on recovery of residues now wasted. There can be no contamination of your product at any time; it never touches raw water. Condensing, of water, of solvents or of your product, is simplified; you have one, compact, easily maintained unit replacing both cooling tower and barometric or surface type condenser.

Niagara Aero Vapor Condenser. This compact machine may be installed directly above stripping column or vacuum evaporator.

Maintenance expense is low. Balanced Wet Bulb Control provide precise, year 'round adjustment of capacity to load.

Constant temperature, uniform products and maximum production 12 months a year are assured. Unit capacities up to 15 million BTU.

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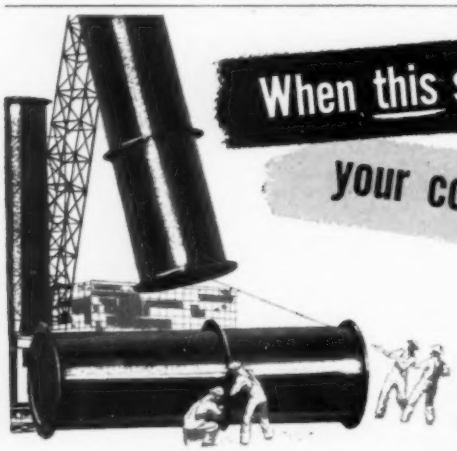
Niagara District Engineers in Principal Cities of U. S. and Canada

Circle 1661 opposite last page



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Circle 1662 opposite last page

LETTERS

Running out of water?

I have read the interesting and thought-provoking article by Mr. A. C. Embshoff, and feel it is very timely. ("Who Says We're Running Out of Water?" Feb., 1958.)

I don't want to be critical, but I can't agree that our experts are crying "wolf." Some years ago our timber lands were cut ruthlessly and not replenished, with disastrous results. Of course, now there is a great deal of reseeding being done and everybody is well aware of the necessity of reforestation, but where is the top soil?

Following the same line of reasoning, why isn't it time that we give consideration to the elimination of all unnecessary waste?

For example, in our small city here, I think we are seven or eight years late on insisting that the direct use of well water for air conditioning be prohibited. There are too many efficient cooling towers and air-to-air equipment available to make it necessary to continue to permit anyone to waste our underground water supply.

I know from direct observation that our water table is now down 30 feet from what it was a quarter of a century ago. Let us face up to the issue and begin to insist that some of the possible methods of water conservation be put into effect.

W. J. NEELY
Plant Engineer
The W. T. Rawleigh Co.

The Depreciation Situation

In your February 1958 issue, on page 18, you showed a nomograph regarding depreciation in capital investment.

This certainly is an interesting nomograph, but there is one point about which I have a question.

Could you describe in complete detail what you mean by "sum of interest (or return), taxes, insurance as %"?

Your advice on this subject would be most appreciated.

H. B. GOLDSTEIN
Plant Manager
Warwick Chemical Company
Wood River Junction, Rhode Island

▶ Admittedly polyglot, the grouping of interest (or return), taxes, and insurance with the "depreciation factor" is the key to making this graphic solution to depreciation possible. Here is how we arrive at it:

With simple interest, total cost of investment, expressed as an average annual cost is —

$$\text{Average Annual Cost} = I(A+B+D)$$

where I is the investment (total cost, in place and ready to run), A is an average allowance for return on investment, B is a similar allowance for taxes and insurance, and D is the annual percentage allowance for depreciation and obsolescence.

But for N years (the estimated life) the proper *percentage return* on the *net depreciated* investment (including normal profit and interest on borrowed funds, if any) must be multiplied by a factor $(N+1)/2N$ to produce A, above. Proper *percentage* average allowance for taxes and insurance on the net depreciated investment must also be multiplied by that factor to produce B.

D can be seen to be equal to 1/N. Algebraically, this is equal to

$$\frac{2}{N+1} \times \frac{N+1}{2N}$$

where $(N+1)/2N$ is the familiar factor above.

So the whole equation can be rewritten in a form which can be solved with a nomograph. Calling *percentage net depreciated* quantities A′ and B′, this equation is —

$$\text{Average Annual Cost} = \left(A' + B' + \frac{2}{N+1}\right)\left(\frac{N+1}{2N}\right) I$$

And the figures given in our Depreciation Function table are actually 2/N+1.

Since the nomograph does work (its error is less than 2% in all our tests), we decided to spare POWER INDUSTRY readers this flight into the abstruse. If our explanation here is, as we suspect, too brief to adequately explain the modus operandi of our mathematical ledgerdermain, try pages 841 to 847 of "Production Handbook," by Alford and Bangs. ◆

SPOTLIGHT ON...

PEOPLE

ASME Fellow's Award goes to **Myron A. Kendall, Stephens-Adamson Mfg. Co.** board chairman. Kendall's unique contributions to the conveyor industry began 35 years ago when he designed for the **H. C. Frick Coal Co.** a 4½-mile-long conveyor system on the banks of the Monongahela River — the first successful long distance belt conveyor. His other contributions include the anti-friction bearing carrier, live-shaft three pulley carrier, self-unloading bulk cargo vessel.

M. A. Kendall

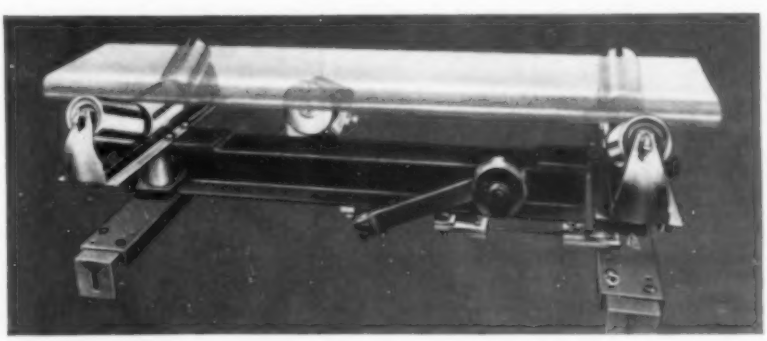
C. L. Burgess

Carter L. Burgess, former president of **Trans World Airlines**, is elected president of **American Machine & Foundry Co.** From 1954 to 1956 Burgess was assistant secretary of defense for manpower and personnel, receiving the Defense Department's highest civilian award, the Certificate of Appreciation.

J. W. McAfee, president of the **Union Electric Company**, becomes president of the **Edison Electric Institute. J. E. Corette**, president of **Montana Power Company**, was elected vice president.

M. W. Kellogg Company appoints new operations vice presidents: **L. J. Kelly** becomes assistant vice president — Engineering; **J. W. Smith** becomes assistant vice president — Construction.

ASHAE elevates to rank of Fellow **Carl F. Kayan**, Columbia University professor of mechanical engineering. He has taught at Columbia's School of Engineering for the past 33 years. ◆



Weigh it on the run ...with electronics

There are no labor costs to be charged against weighing when you incorporate a Fairbanks-Morse electronic scale in your belt conveyor system. The belt will be moving anyway, and might as well be accumulating the record of passing weight in the process.

Because it is electronic, the registering instrument of the new Fairbanks-Morse Electronic Belt Conveyor Scale can be located remotely—for instance in the office with the rest of your business and accounting machinery.

Accumulated weights are read on the remote instrument in digital figures, and there are other indicators to give you a running check on the general efficiency of your conveyor operation. A meter shows percentage of load at the given moment; another shows the rate of tonnage movement per hour.

There's a new bulletin, No. ED-12, on the Fairbanks-Morse Electronic Belt Conveyor Scale. Please write for it today. Fairbanks, Morse & Co., Dept. PI-4, 600 South Michigan Avenue, Chicago 5, Illinois.

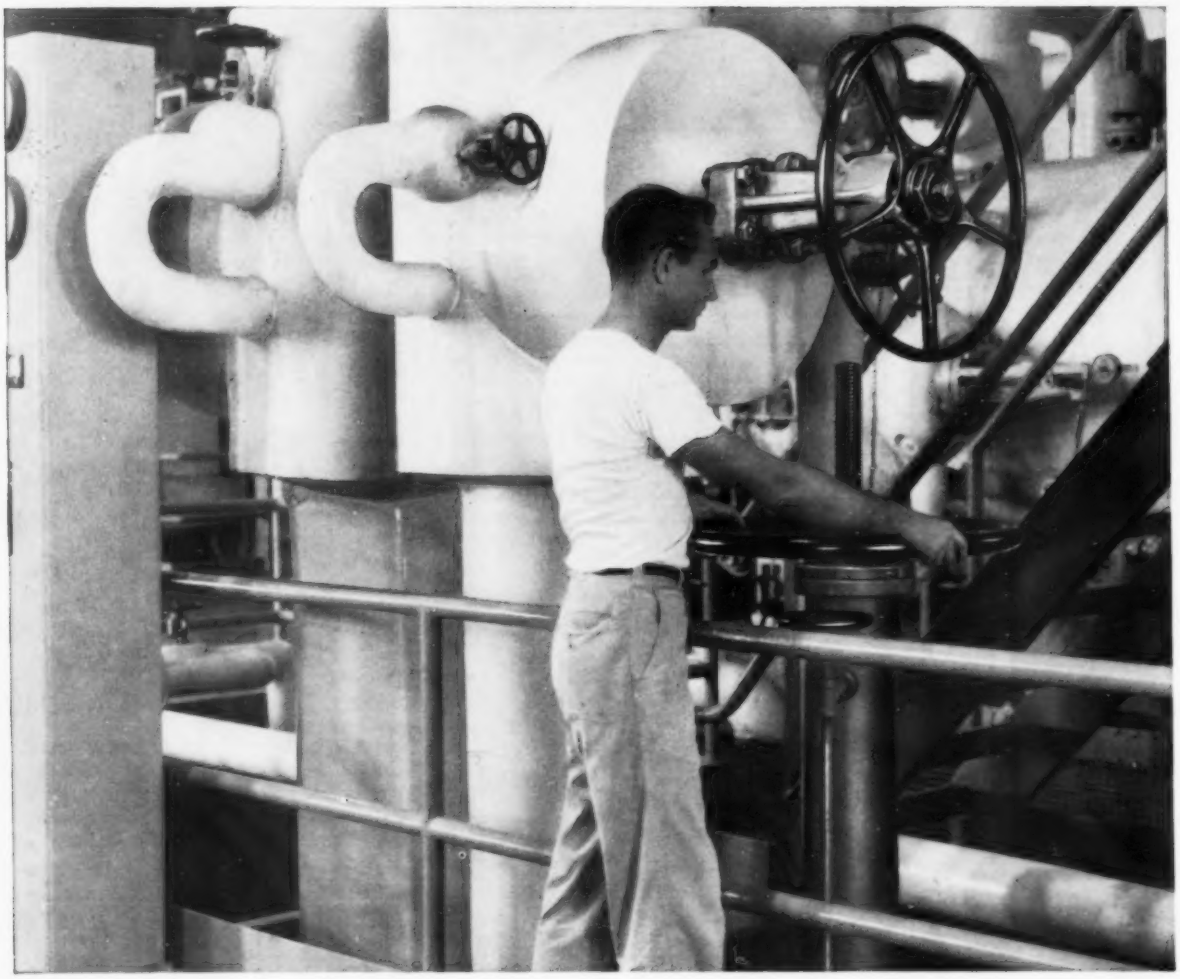
FAIRBANKS-MORSE

a name worth remembering when you want the BEST

SCALES • PUMPS • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

Circle 1663 opposite last page

How Crane Steel Valves Cut Power Piping Costs



Everything's O.K. below—since 1942

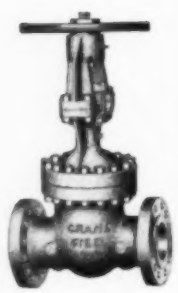
Always smooth, always positive in action—says the operator of this Crane 10-inch, 600-pound steel gate valve with extension yoke . . . and never a sign of leakage at the seats or bonnet joint.

That's the way this valve has performed for 15 years—since it was installed in a main steam cross-over line in the Nueces Bay Station of Central Power & Light in Corpus Christi. It's on working pressure of 400 psi at 830 deg. F.

The cost-in-service record of the valve is clean. It has not been touched by a mechanic except for ordinary routine servicing. Indications are it will remain in the line for a long time to come.

Unusual performance? Not for Crane steel valves. They're famous for cutting power piping costs. They're better suited for such service because of quality castings made in Crane's own foundry—with closely controlled heat-treating techniques . . . exacting machining, assembling and testing procedures that are unique with Crane.

You can be sure of low-cost steel valve performance when you specify Crane. Get all the facts from your Crane Representative or write to the address below.



CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers in All Areas

Circle 1664 opposite last page

SPOTLIGHT ON...

GROWTH

expansions

Rust-Oleum Corp., Evanston, Ill., has completed $600,000 plant expansion program. New production facilities include 12,000 sq ft warehousing unit, new ball mill equipment, and a new automatic packaging system.

The Cooper-Bessemer Corp., Mt. Vernon, Ohio, is forming an *Electronics-Controls Division* to keep up with trend toward automation in power and compressing operations for pipeline, petrochemical, and industrial plants. Reed D. Hamilton heads new division.

Link-Belt Co. opens its newest plant in Montebello, just outside Los Angeles. Plant houses manufacturing facilities, engineering department, district sales office, and factory branch store.

mergers

Beckman Instruments Process Instruments Division announces that it will continue to produce and market oxygen and dissolved oxygen analyzers, gas density balances, and thermal conductivity and combustibles analyzers formerly produced by **Arnold O. Beckman, Inc.**, which was recently acquired by Beckman Instruments.

Lithium Corporation of America, Inc., Minneapolis, and **Brooks and Perkins, Inc.**, Detroit, form working agreement to develop new lithium-containing metal alloys commercially. Both will first do research on alloys containing lithium and other metals.

H. K. Porter Co., Inc., announces it has acquired from the **Graham-Paige Corp.**, and certain of their associates holdings of **Thermoid** common stock. Acquisition of additional Thermoid stock is under consideration by Porter. ◆

APRIL 1958
VOL. 74 NO. 4
POWER INDUSTRY

THIS IS YOU!

Findings of the Purdue Opinion Panel show that teenagers see scientists in this light . . .

- **54% think scientists are likely to be radical in matters outside their field**
- **53% think scientists have no thought about the consequences of their work**
- **34% think scientists cannot have a normal family life**
- **30% think scientists are impractical in everyday living**
- **28% think they are "more than a little bit odd".**

These attitudes should alarm you. They are the feelings of the very high school kids (though, 65% object to this word) who are now deciding about a future career. They are the people you'll have for neighbors a few years hence.

Under the direction of Dr. H. H. Remmers of Purdue University, thousands of high school sophomores, juniors, and seniors were queried. Scrupulous sampling and interpretation were applied to this study.

The results are not pleasant reading. They are not trivial. Those listed above indicate some of the more stereotyped concepts of scientists in the teenage mind. While fewer teenagers hold these feelings, the picture becomes uglier when you note that:

14% believe there is something evil about scientists

30% believe that scientists can't raise a normal family

38% feel that you would sacrifice the welfare of others to further your own interests.

And for a really fundamental misunderstanding, look to the 9% who feel that "a person cannot be a scientist and be honest."

It Started with Frankenstein

Our present pace of applied science must be unnerving to the layman. Certainly, Hollywood makes no bones about blaming scientists for "the present mess." As people and as groups, engineers and other technical professionals have not made a dent with public relations efforts.

On the other hand, think of the public attitude toward medical doctors. The work of the American Medical Association has made the very phrase "medical doctor" far less common than "family doctor." Do you suppose that teenagers would consider their family doctor a "scientist?"

To berate our technical societies for failing is silly. Our societies are made up of us! It seems to be time for us to do something. We should be able to . . . 35% of the teenagers think we're all geniuses.

Summary of Findings — High school students' attitudes toward the values of scientists and their personal characteristics were measured. They were asked if they plan to be scietists. The large majority would not; 21% say they would like to be scientists and another 17% say they are undecided, but **probably** they would.

Even though most youths think they would not like to be scientists, the majority express favorable opinions — toward scientists.

However, scientists are looked at by many students as being different from most people.

19% think scientists are more likely than other people to be mentally ill;

20% think scientists have little regard for humanity;

25% think scientists in universities are removed from everyday life;

14% think scientists are likely to be unpatriotic;

23% think most scientists are not religious.

According to 50% of the teenagers, the government should control scientific findings. Opinion is also divided as to whether the willingness of scientists to reject tradi-

continued on page 38

SAFETY ..... A WAY OF L

By ROBERT S. STEVENSON
President
Allis-Chalmers Manufacturing Co.

Safety for safety's sake can stand on its own two feet and fully justify the enormous expenditures of time and money devoted to it each year. But safety, particularly as it concerns industry, is a horn of plenty. It overflows with built-in opportunities for industry to better meet its responsibilities to customer, shareholder, community, and dealers, as well as employes.

At the same time, it strengthens industry's ties with these groups.

Rightfully, accident prevention has primarily in mind the well being of the person who works in a plant or who uses a product made in that plant. Keeping this in mind, there is no reason why accident prevention programs cannot be made to serve in other ways as well. Well conceived safety improvements and programs are salesmen, goodwill ambassadors, cost-savers.

Safety actually is a common denominator — and a high common denominator at that. Almost any phase of safety can be made to apply to a number of audiences, and to produce a favorable effect.

Everything Counts

For example, a safety tool as commonplace as safety glasses is invaluable. Glasses are distributed to truck drivers entering the plant area, to customers visiting the shops, to touring students and civic groups. Requests that they be worn indicate that industry is sincerely concerned that no harm befall either employe or visitor. Subtly, the industry reveals itself as a warm and personal entity.

Through a well-balanced program, measurable effects of sound safety practices appear in the form of low accident frequency rate statistics. From these safety studies, it has been estimated that plants lacking good programs can expect an average accident frequency rate 2½ times higher than the plant with a sound safety policy.

At Allis-Chalmers, the safety policy makes safety every employe's business, idealistically strives to "generally advance the well being and standing of the company, its people and its customers."

It achieves this through effective accident prevention programs both on and off the job.

This is a high goal which Allis-Chalmers has in common with industry as a whole. Steps to attain this goal, of course, begin right in the shops and offices — where the most obvious concern is employe protection.

All personnel are constantly

"Take any example of safety and you are certain to realize that it's working for industry harder than realized."

Robert S. Stevenson has been president of Allis-Chalmers since April 19, 1955. Prior to that, he served as executive vice president for nearly three years.

Stevenson has been associated with Allis-Chalmers since 1933 when he joined the Kansas City tractor branch as a salesman. Two years later he became assistant manager of the Omaha, Nebrska, branch. In 1936 he was named assistant southwest territory manager and later in the same year was appointed manager of the Tractor Group's northwest territory.

In 1941, Stevenson became southwest territory manager and in 1948 he was promoted to assistant general sales manager. Two years later Stevenson was named general sales manager of the Tractor Group and in 1951 vice president in charge of that group. He was named executive vice president of the company July 2, 1952.

Born in Seattle, Washington, on November 10, 1906, Stevenson attended high schools in Spokane and Portland, Oregon. He attended Whitworth College in Spokane and was graduated from Washington State College, Pullman, Washington, in 1929.

Stevenson is currently serving as president of the Farm Equipment Institute. He is a past director of the National Safety Council.

F LIFE FOR INDUSTRY

reminded by formal programs, posters, emblems, literature, and many other devices that personal safety is one of their chief concerns, at home and on the highway, as well as at work.

Industry's Responsibility

Industry has a responsibility to provide its employes, who make its existence possible, with a safe place to work by eliminating all possible sources of accidents. By meeting this obligation, industry is setting the stage for smooth employe relations, which itself is ample return for the effort.

But, by taking precautions that reduce accidents, the other audiences to which industry is responsible are indirectly affected.

Recognition of hazards on any job and a sound engineering approach to their elimination will improve productive efficiency, either directly, or indirectly by avoiding accidents.

Fewer accidents mean lower operating costs through lower medical and workmen's compensation payments. The manufacturer can turn these reduced costs into a more competitive product, opening the door for increased sales and broadening the smile of the stockholder.

The customer, paying less for a product, similarly is happier. Dealers or distributors, selling to the customer, become a part of this pleasant chain reaction.

And it's not over yet, for a low accident rate increases company prestige in the eyes of the community. This reputation carries with it a label, "A good place to work," and makes it that much easier for industry to continue to attract quality personnel.

". . . off-the-job policies can work wonders in solidifying industry's position in the community."

This entire cycle is repeated when accidents causing property damage are reduced.

Accident prevention and better methods are another inseparable pair which work for the benefit of a multiple audience. For example, the foresight that specifies the simple addition of lifting lugs to parts of heavy turbines and generators makes possible safe and efficient handling of a product as it is fabricated, machined, assembled, and moved inside the plant.

Play to Audience, Too

After the product reaches its destination in the field, savings and safety are emphasized again, in full view of the customer.

Safety features built into equipment, moreover, afford salesmen with powerful talking points when they approach a customer. The addition of improved functional features and fatigue reducing devices, to be sure, contribute immensely to a safer workday. And the salesman can also point out that a less tired worker is a safer worker. In short, the safer of two products will be easier to sell everytime.

While on-the-job safety programs primarily affect those audiences concerned with the manufacture and use of the product, off-the-job policies can work wonders in solidifying industry's position in the community.

Safety advertisements in local newspapers, over radio and television, sponsored as a public service, show that industry wishes to be a good neighbor.

Support of back-to-school and vacation safety campaigns again helps "humanize" a company as an organization of people, when it is all too often thought of only as a company.

In addition, industry's wealth of safety films, along with trained safety personnel, can be made available to church, PTA, Boy Scout and similar groups. This same material, along with safety manuals, data sheets and other educational matter, can be of value to customers and dealers. Community and customer alike may also be interested in ideas presented in industrial safety campaigns.

The customer, in turn, may use this material in his own community, thereby broadening industry's field of contact.

Then, through improving community relations, the possibility of improving employe relations also increases. As members of the community, employes most certainly will take pride in any company program that attempts to foster the good of any group of which they are a part.

Take any example of safety and you are certain to discover that it's working for industry harder than realized. ◆

SAFETY IN YOUR PLANT— WHOSE RESPONSIBILITY?

Next month, POWER INDUSTRY brings you an organizational outline to help you formulate a safety program. Safety Director W. T. Rogers of Ebasco Services, Incorporated, points out that safety begins with design. Engineers initiate the chain-reaction of safety on their drawing boards. Safe equipment must, however, be followed with a consistent program of training, supervision, inspection, and active management participation.

Luring the Class Pisces onto a curved, barbed hook requires much patience and knowledge of their habits. But, there are times when it is better to know . . .

how NOT to catch fish

Combination of electric screen and trash rake give the best protection against fish entering into system.

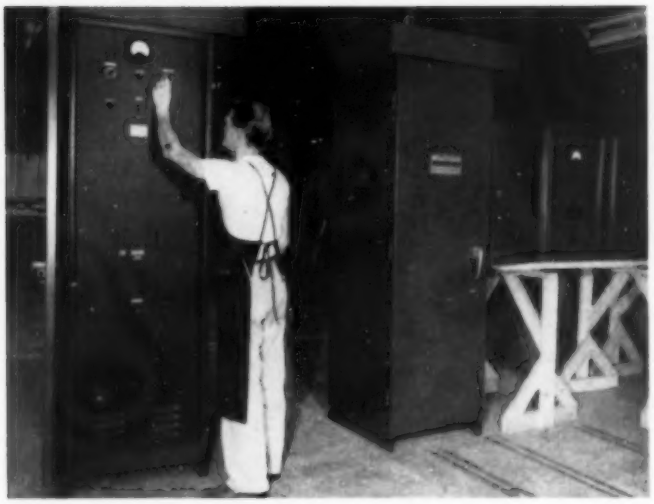
By H. S. BURKEY
Research Associates
Los Angeles, Calif.

Izaak Walton enthusiasts may find it difficult to believe, but *not* catching fish is a serious problem for engineers concerned with operating municipal waterworks, hydroelectric plants, steam generating facilities, industrial pumping equipment, and irrigation districts. It is a problem not only because fish can damage expensive equipment, but because everyone has both legal and moral reasons for eliminating conditions that can destroy valuable natural resources. Fortunately, this problem now has a solution.

Stationary and traveling metal screens have long been the most commonly used devices to keep fish and debris from entering water intakes. Insofar as debris is concerned, they remain indispensible. They have two great disadvantages as fish barriers, however.

First, it is not always practical to use a metal screen with apertures that can exclude the smallest fish. And second, any such mechanical barrier is apt to become clogged — thus imperiling plant operations — whenever there is a heavy run of fish. Therefore, the electric fish-screen has been used as a supplement to conventional intake barriers with varying degrees of success in recent years.

The electric fish-screen is an invisible zone of electrified



Typical pulse generator, to provide power for electric fish screens, are tested after leaving the final assembly line.

water, created by an energized electrode system. This zone is strongest in the area between the electrodes, but has gradually decreased strength at points ranging from 10 to 20 feet away. Consequently, fish entering or approaching the electrified area receive shocks in direct proportion to their size.

Don't All Work

Not all electric fish-screen installations have been completely successful because some have made use of ordinary ac or dc. In addition to consuming too much power and electrolytically dissolving their own electrodes, the latter installations frequently killed fish and sometimes jeopardize human lives. However, experience has repeatedly proved that electrodes energized with pulsed electronic current create a screen that is simultaneously harmless, effective, and economical to operate.

Electrode system for a screen of the latter type is usually designed so that the field or zone is directional, or parallel to the flow of water. Fish ordinarily travel lengthwise with water currents and thus receive optimal shocks in this position.

Small fish, having the least surface area, may swim closer to the electrodes than large fish before they receive uncomfortable shocks. However, both large and small fish are eventually compelled by current-induced pain to turn at right angles to the flow of water. Since this instantly reduces the shock they have experienced, they instinctively turn and flee from the electrified zone.

Pulse frequency, duration, and current intensity used to divert fish in this manner depend on a variety of factors — including intake size, water velocity and conductivity, and the species of fish to be repelled.

In general, screens operating in salt water must use pulse generators with much higher capacities than those in fresh water installations. But if adequate circuitry and appropriate wave forms are employed, large-capacity generators can be operated with input wattage low enough to be economically feasible for most practical purposes.

Because of the extremely short pulse duration ordinarily used, electrolysis is kept at a minimum when a pulsed-current screen is employed in either fresh or salt water. It is desirable, however, to reverse the polarity of pulses at regular intervals where an installation is exceptionally large and the load is heavy.

First Practical Screen

In operating the first truly practical electric fish-screen, it was necessary to use a synchronous commutator and brush combination to pick off periodic cycles. This device was quite effective, but required considerable maintenance because gradual gear wear caused arcing due to a loss of synchronous timing. For many practical purposes, this deficiency was eliminated following the development of the Thyratron tube. This grid-controlled rectifier made it possible to pulse relatively high currents without moving parts. However, the electric fish-screen could not be used in large areas until the high-peak current capacity of the ignitor-fired mercury-pool rectifier known as the Ignitron became available.

Typical Users

In circuits for salt water applications, it is sometimes desirable to make simultaneous use of two or more Ignitrons in pulse transformers. These must be positioned as close as possible to an electrode system in order to assure high current values.

Typical industrial users of electric fish-screens in fresh-water regions are firms like Campbell Soup Company and Container Corporation. Condenser discharge waters from these firms attract literally millions of small fish such as smelt, gizzard shad, minnows, perch, chubs, and bass, simply by slightly increasing the water temperature. Most of these plants previously had grids or screens to sieve out fish and debris. The mechanical devices became clogged and inoperative, however, at times when fish were too numerous.

Eels & Lampreys

Similarly, Standard Oil Company and other users of industrial pumping equipment in coastal regions now save thousands of dollars annually by electrically preventing damage due to massive eel migrations. Mechanical barriers once provided some protection for the pumping units. But when barriers were covered with eels, pump suction was starved and expensive equipment was damaged. Some users claim electric fish-screens have paid for themselves simply by reducing the number of times their mechanical barriers must be cleaned each year.

While the primary purpose of an electric fish-screen is to divert fish, without killing them, there have been circumstances where it was desirable to use current to exterminate marine life. One such instance occurred following the advent of the sea lamprey in the Great Lakes a few years ago. The sea lamprey virtually decimated sports as well as commercial fishing in the Great Lakes. This was a matter of much concern to the governments of both United States and Canada. A pilot fish-screen was installed at Marquette, Mich., in 1951 to determine the possibility of killing sea lampreys without harming valuable food fish.

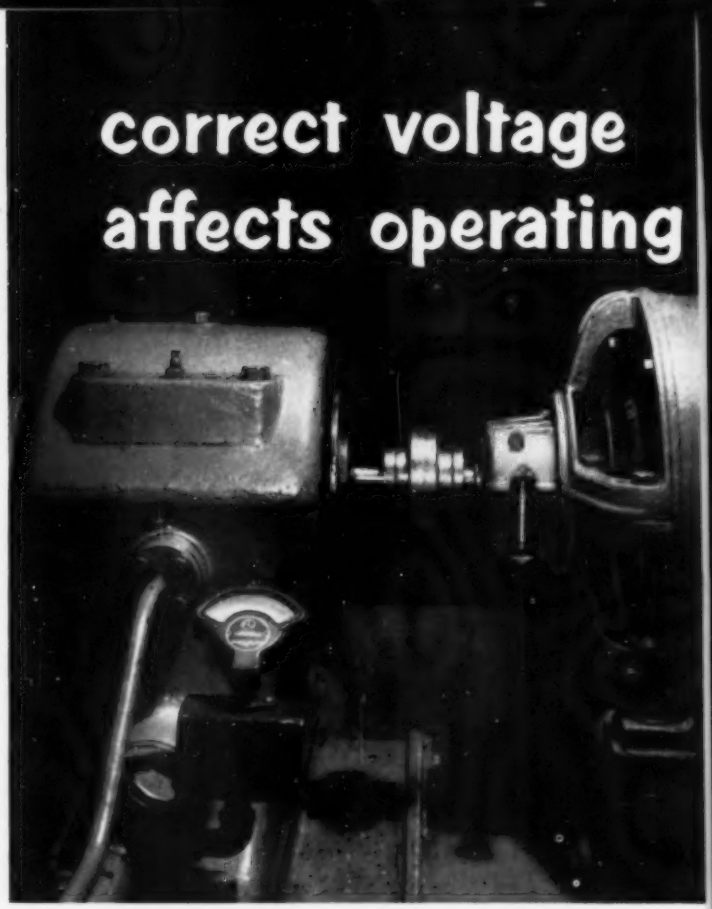
A number of special versions of electric fish-screens have been developed. Newest and perhaps most interesting device in this category is a portable unit designed to protect skin divers and personnel aboard survival rafts at sea by driving away sharks, moray eels, and other dangerous fish. It consists of a lightweight power pack, which can be attached to a skin diver's aqua lung or clamped in a survival raft, and a manual gun-type electrode.

(Fish screens were supplied by Research Associates Laboratories, Inc., 2729 W. Vernon St., Los Angeles, Calif.) Circle 1665 opposite last page.

correct voltage affects operating

Varying voltage at motor terminals can run up operating costs. Your motor operates most efficiently at design voltage. Here's how . . . . . .

By C. T. BAKER
Consulting Engineer
Atlanta, Georgia



High operating efficiency starts with correct installation and continues with supplying the correct voltage to the motor.

Problem: A large ice making and cold storage plant had a connected load of 600 horsepower. The load consisted of 3-phase, 60-cps, 550-volt motors, ranging in size from 3 to 250 hp. For some years, power costs were in line and management was satisfied with the Utility Company's service.

Conditions changed, however, and power costs per unit of output increased considerably. Plant operations were studied to determine the reasons for the power cost increase.

One important fact was disclosed by the investigation. Voltage delivered to the plant incoming switchboard and to the motors, was much higher than specified in the power contract. It varied from 600 to 625 volts.

Some years before the investigation, voltage on the transmission line serving the ice and cold storage plant and several other large users had been increased from 13,200 to 13,800 volts. At times, potential was boosted to 14,500 volts. The voltage on this feeder was increased to boost a 44-kv feeder serving certain other large consumers in the area.

Solution: Secondary current was supplied to the company through 3200-kva single-phase transformers. To learn how the higher voltage would influence motor efficiency, motor name plate data was sent to the manufacturers.

Operating efficiencies were requested for 500 and 625 volts for two large motors. The comparison was requested for 550 and 600 volts for several induction motors. The tabulation below was obtained:

The list does not include all motors installed. Only those operating during the off season are listed. During the hours from 5 pm to 7 am, voltage delivered to the ice company averaged 625. This was due to the over-night shutdown of many industrial plants in that area.

With current costing 0.012c/kwh including the demand charge, it is quite evident that the loss in efficiency is a big item in power costs.

Percent Load		25%	50%	75%	100%	125%
		Percent Efficiency				
One 250-hp	625 Volts	79.	87.5	90.	91.	91.2
Slip Ring Motor	550 Volts	81.6	88.7	91.	91.7	91.5
One 175-hp	625 Volts	-	89.8	91.8	92.5	92.7
Unity P.F.						
Synchronous Motor	550 Volts	-	91.4	92.5	92.7	92.4
One 40-hp	600 Volts	75.8	84.7	87.	87.5	87.
Induction Motor	550 Volts	78.8	85.7	87.4	87.6	87.2
Two 5-hp	600 Volts	59.5	73.3	78.4	80.7	81.
Induction Motors	550 Volts	62.	74.5	79.3	81.1	81.3
Two 3-hp	600 Volts	67.5	78.5	82.	83.4	83.1
Induction Motors	550 Volts	69.5	79.7	82.7	83.6	83.3

Over-voltage Effects

Over-voltage on sychronous motors increases the amount of excitation in the field coils necessary to maintain a given power factor. Consequently, a reduction in motor efficiency follows.

Small over-voltages may be advantageous where motors are overloaded. However, over-voltage may result in a reduction in power factor. This in turn, could result in increased power bills.

The transformers supplying the ice plant had no voltage changing taps. It was necessary to provide three-single-phase bucking transformers to reduce the secondary to 550 volts. This reduction resulted in a decided drop in power consumption.

There has been much talk in recent years concerning the ability of a motor to operate satisfactorily on voltages 10% above or below motor design voltage. Many motor users have become so brainwashed with this idea that they give little thought to voltage when purchasing new motors, as long as they come within range of the plus or minus 10% guide post.

Many 220-volt motors operate on 208-volt circuits. The writer has checked voltage at the motor terminals on several 208-volt circuits. They did not show 208 volts. They were actually 203 to 205 volts.

In each instance, the motor was wound for 220 volts. Each

was fully loaded and each ran entirely too hot for comfort and too hot to be efficient.

Power users will do well to forget all the "wattless conversation" about this plus or minus idea. They should keep in mind the fact that the closer the delivered voltage fits the voltage for which the motor was built, the greater the efficiency and the longer the life. ◆

STEAM
...on schedule

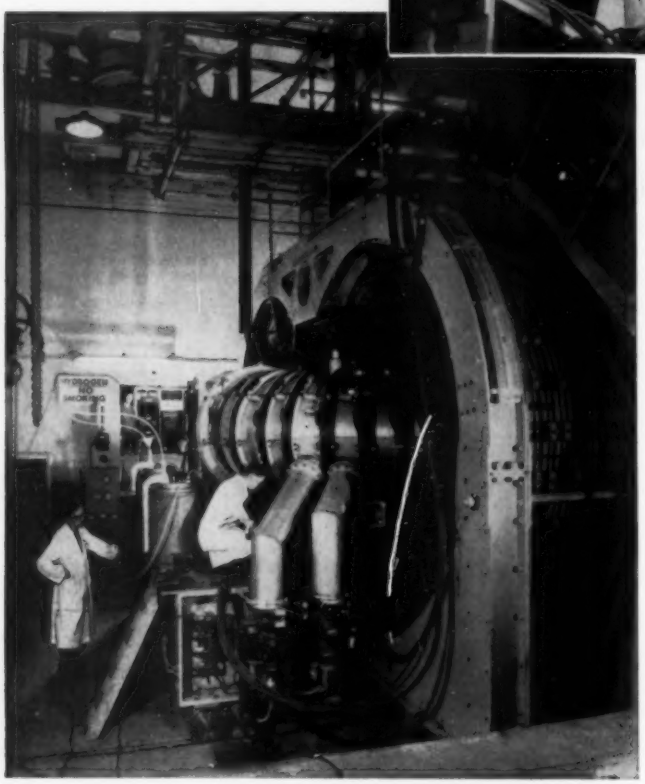
Old Ben Coal is the "Old Faithful" fuel for low cost steam when you want it, where you want it. Although more than 200,000,000 tons of this genuine Franklin County coal have gone to market, there's still a hundred-year unmined supply.

Old Ben Coal corporation
360 W. Jackson Blvd.
Chicago 6, Illinois

Circle 1666 opposite last page

Scientist adjusts a vacuum valve on vacuum exhaust tube. Hot gas has been isolated from wall for periods of 2 to 5 milliseconds and heating proces repeated every 10 seconds. Periods of several seconds probably will be required for a useful power output

Part view of torus, with vacuum pumping system in foreground. Coils wound on torus produce a stabilizing field, which helps prevent hot gas touching torus wall



Here's the answer to the question . . .

what is ZETA and fusion reaction?

Operation of present atomic reactors is based on the fission (or splitting) of atoms. Possibility is now being explored both here and in England of harnessing power from the fusion (or joining) of atoms — as it occurs in stars.

Results obtained from the apparatus ZETA at Harwell, England, suggest that thermonuclear neutrons have been formed. Temperatures as high as 5 million degrees C have been reached.

If it proves possible to construct a power station operating on the fusion of deuterium, the oceans will provide a virtually inexhaustible fuel source.

But don't expect fusion to be harnessed for power for a long time. Present development is comparable to the start up of the first fission reactor in December, 1942.

Reaction being studied in ZETA involves deuterons (nuclei of the heavy hydrogen isotope deuterium), which collide with one another and fuse to form heavier nuclei.

This releases energy and some neutrons in the process. For fusion, the deuterons must have enough energy to overcome the initial electric forces of repulsion between them. This necessitates heating the deuterium gas to temperatures of millions of degrees C. The hot gas must be kept away from the walls of the container, otherwise its temperature falls.

Principle adopted in ZETA is to pass a large electric current through deuterium gas. This current sets up an electric discharge in the gas (analogous to the discharge in a neon sign), which heats it and also produces an intense magnetic field around the column of hot gas.

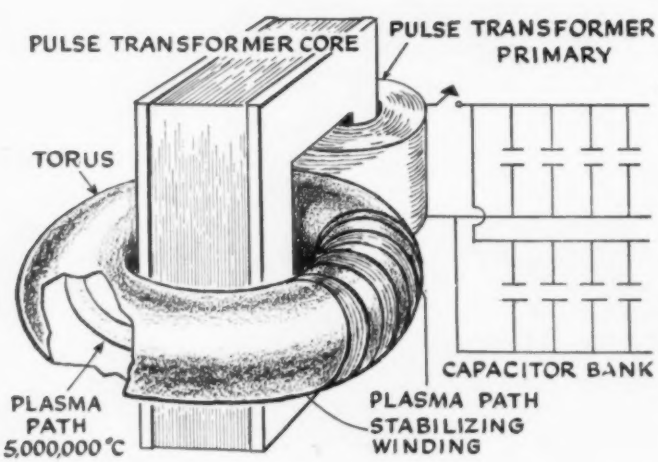
This magnetic field constricts the discharge and heats it still more. Since it also causes the discharge to wriggle about, this field by itself is not enough to keep the discharge away from the walls. The wriggling has been suppressed by applying an additional steady magnetic field parallel to the axis of the tube.

In ZETA, the discharge chamber is a ring-shaped tube or torus of 1 meter bore and 3 meters mean diameter, containing deuterium gas at low pressure.

The tube is linked (*i.e.*, encircled over part of its length) by the iron core of a large pulse transformer. A pulse of electric current is passed into the transformer primary winding from a bank of capacitors capable of storing 500,000 joules of energy. This pulse in turn induces a very large unidirectional current pulse in the gas, which forms a short-circuited secondary for the transformer.

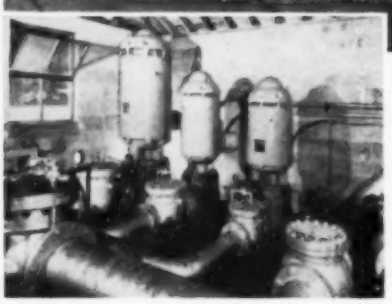
Peak currents up to 200,000 amperes have been passed through the ionized gas for periods up to 5 milliseconds. The current pulse is repeated every 10 seconds. Neutron emission throughout the current pulse is observed regularly in routine operation of ZETA with deuterium. Up to 3 million neutrons are emited per pulse.

Many major problems are still to be solved before its practical application can be seriously considered. But it's coming! ◆



Schematic of ZETA shows principal parts

Water capacity is selected by pushbutton at this control panel.



Six pumps, from 20 to 100 h.p. each, handle total cooling water requirements.

Recirculation system . . . speeds diesel engine tests

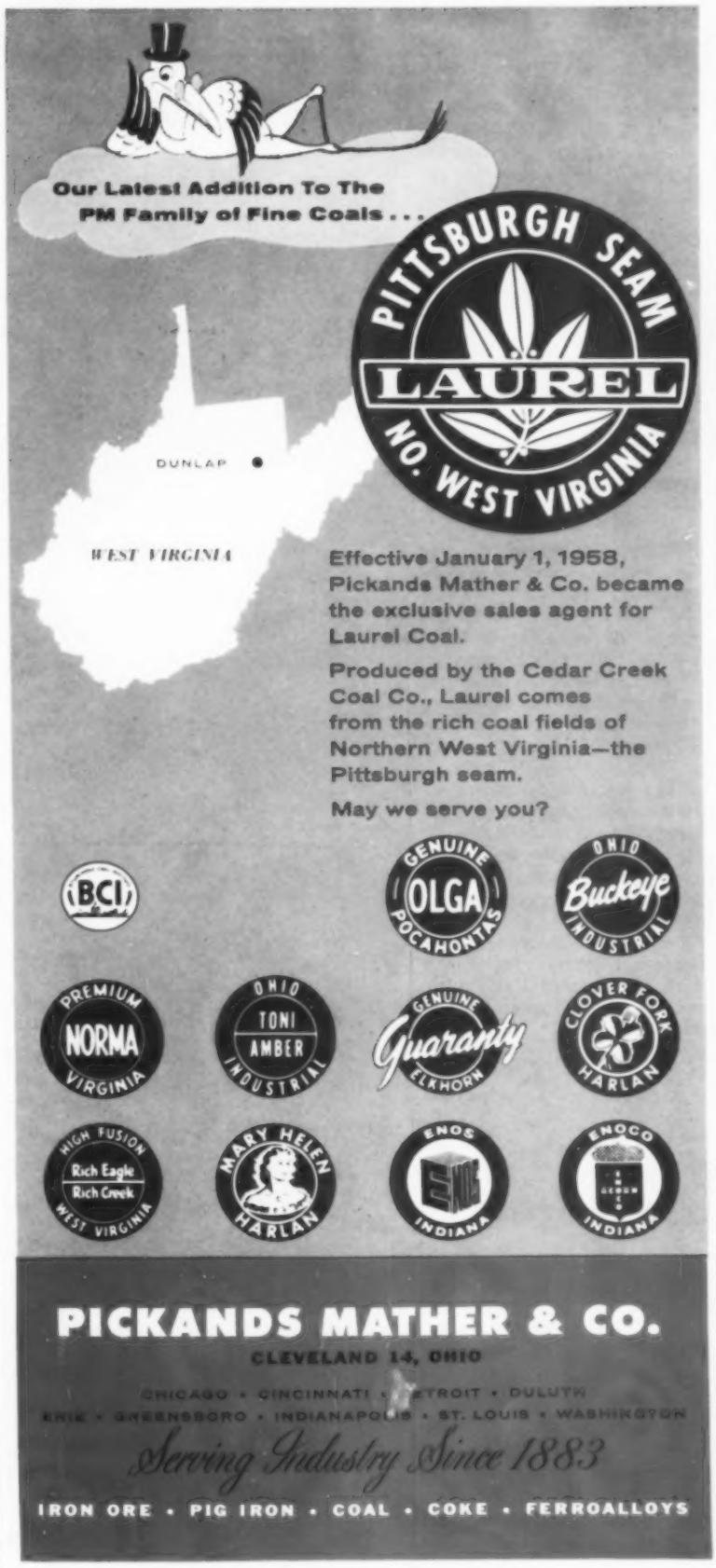
A foolproof recirculating water system speeds diesel engine testing and conserves thousands of gpm of plant water at The Cooper-Bessemer Corporation, Grove City, Pennsylvania.

A 3000 gpm closed water system permits simultaneous testing of engines totaling 19,600 h.p. The water cools Proney brakes used to test load Cooper-Bessemer diesel engines. Electric controls provide close supervision of the water supply from a pushbutton station on the test floor.

Two of the plant's four wells previously supplied water to the test floor, in addition to providing many other water requirements. Testing many engines at once, under various load conditions, water demand varied sharply. The result was imperfect control of water supply at the test floor and occasional low pressure in other areas of the plant.

To remedy this, Plant Engineer Richard N. Campbell ordered an independent recirculating water system to supply test water. The system included a cooling tower, hot and cold water sumps and necessary piping and pumps. Dearing and Company supplied the pumping system, consisting of six Deming short-setting turbines and electric controls to operate them.

Hot water from the engine tests stands drains into the hot sump below the floor. One, two, or three Deming turbines pump the water 650 feet, discharging it atop a 40-foot cooling tower. The tower is an induced-draft type with three separate cells. Each has a capacity of 1000 gpm under 75°F wet bulb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Circle 1667 opposite last page

conditions. Two-speed fans force air through the tower cells.

Water drains through the tower by gravity into the cold sump beneath it. Another combination of three Deming short-set turbines pumps it back to the test floor. A 12-inch line from the cold sump splits into two 8-inch headers that run 200 feet along a double row of engine test stands. Four-inch drop-off lines feed each stand.

Hot well pumps are 20, 30 and 40 h.p. Cold well pumps are 40, 60 and 100 h.p. They maintain 50 psi in the main headers on the test floor. The three pairs of Deming pumps circulate 500, 1000 and 1500 gpm respectively.

One Pushbutton

The supervisor selects water volume with six pushbuttons, marked 500 to 3000 gpm. Pushing one button operates all necessary switches and valves to supply the corresponding water volume at operating pressure. This includes starting motors on the proper combination of pumps, opening valves in lines to cooling tower cells, and starting tower fans at the required speed.

An added safeguard maintains pressure during a change from one pumping stage to another. When the supervisor sets the system (already operating) to the next higher stage, an automatic timer keeps all pumps running for 50 seconds to provide carryover capacity. This keeps water supply ahead of demand during the change.

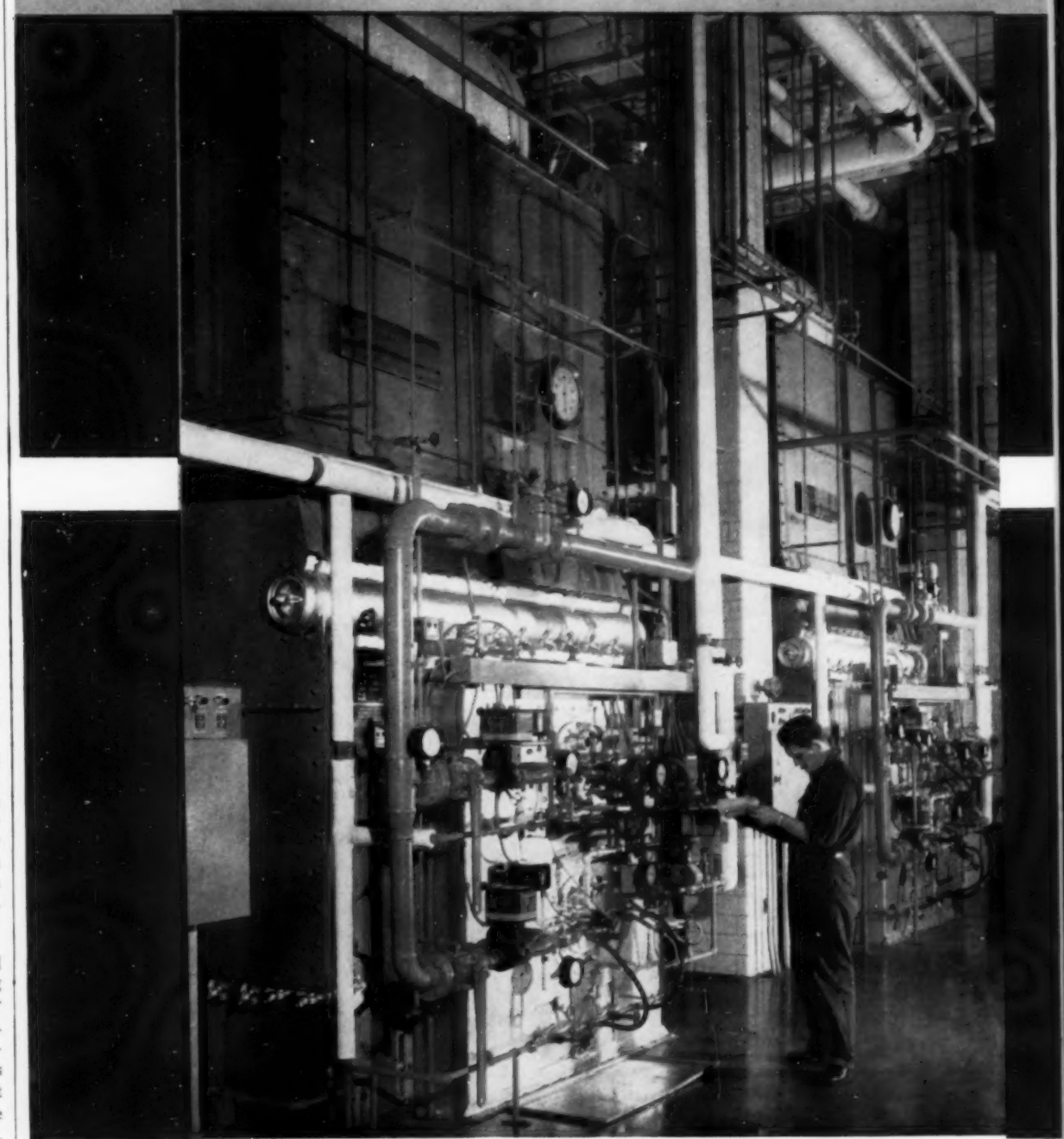
Two thermostats in the cold well control the critical temperature of test water. One switches all cooling tower fans between high and low speed. The other, set at a lower value, switches fan drives between low and off.

Automatic Protection

A low-water-level control cuts off the entire circulating system if water level in either sump drops dangerously low. A low-pressure warning device blows a horn and lights a warning light on the test floor when pressure at the floor drops below 40 pounds. Makeup water is supplied

WICKES TYPE S-1AL

HEAT ONE OF AMERICA'S



STEAM GENERATORS
MOST MODERN BUILDINGS

CONNECTICUT GENERAL LIFE INSURANCE CO., Bloomfield, Conn.

ARCHITECTS: Skidmore, Owings & Merrill

GENERAL CONTRACTOR: Turner Construction Co.

MECHANICAL CONTRACTOR: Kerby Saunders, Inc.

A recent exhibit at the National Gallery features 10 of America's most modern buildings. The American Institute of Architects, on the occasion of its Centennial, included in the exhibit the new home office of the Connecticut General Life Insurance Company in suburban Hartford, which is equipped with Wickes boilers. This spacious, sun-flooded building of steel and glass, is nearly a modern city in itself, for it houses not only the complete office system, but includes employee lounges, game rooms, medical department, mailrooms, auditorium, bowling alleys, barber and beauty shops as well.

For the heating system in this mammoth structure, engineers chose to install two Wickes type S-1AL steam generators equipped with both oil and gas burners. In addition to general heating, the steam generators provide power to operate the refrigeration machines and a snow-melting system on the truck ramp. The boilers each have 3700 sq. ft. of heating surface, and were designed for a maximum continuous load of 27,500 pounds of steam per hour at 200 PSIG.

Bulletin No. 55-1 gives complete facts on Wickes products. New engineering bulletins on Type-S and Type-A Steam Generators are also available on request.

WICKES

WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • *SALES OFFICES:* Boston • Chicago • Cleveland • Dallas • Denver • Detroit • Houston Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • New Orleans • Portland, Ore. • Saginaw San Francisco • Springfield, Ill. • Tulsa

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Circle 1668 opposite last page

automatically from the plant's general water system. A float switch in the hot sump controls a solenoid valve which introduces plant water into the sump. Maximum makeup is about 250 gpm, required to replace evaporation loss and a blowdown that removes solids.

(Short-setting pumps are products of the Deming Company, Salem, Ohio).

Circle 1669 opposite last page.

Packing adapts valves for 450°F temp range

Teflon-coated asbestos valve packing adapts valves for hot and cold water, steam, air, oil, ethylene glycol, at temperatures of −50 to 400°F at pressures to 250 psi.

Packing can be installed on any valve now using Powers Regulator Co.'s present standard packing.

In lab tests, packing held tight for well over 40,000 cycles. Remains resilient at low temperatures. Partially self lubricating — can be used without a stem lubricator.

Companion pieces are redesigned two-piece packing gland assembly for better stem guidance and on improved packing spacer.

(Powers No. 590 packing, gland assembly, and spacer are products of The Powers Regulator Co., 3434 Oakton St., Skokie, Ill.)

Circle 1670 opposite last page.

Ceramic releases moisture slowly

Ceramic compound, made from special clay that remains highly porous yet strong, retains molded shape despite its high moisture content. Ideal for deodorizers, air conditioners, humidifiers, other applications where moisture retention for gradual release is necessary.

Ceramic may be glazed or unglazed. Wide choice of colors available.

Thermal expansion coefficient is 6.9×10^{-6} in temperature range from 25° to 700°C. Bulk specific gravity is 1.24; water absorption 40%.

(Vaporlain is made by The Star Porcelain Co., 34 Muirhead Ave., Trenton 9, N. J.)

Circle 1671 opposite last page.

POWER BASICS FOR TODAY'S INDUSTRY

Heat transfer – I

HEAT TRANSFER AND CONDUCTION

by JOHN F. LEE
Distinguished Professor and Graduate Administrator
North Carolina State College

Heat transfer is concerned with the mechanisms by which energy, in the form of heat, is transferred between parts of a system or from one system to another.

The rates at which heat transfer takes place, and the application of thermodynamic laws to predict the direction of heat transfer are also involved. Heat transfer may occur through three mechanisms — conduction, convection, and radiation.

Although these are distinct modes of heat transfer, it is usual for more than one mechanism to be in operation at the same time. It is quite common, however, for one mechanism to predominate.

Characteristically, conduction heat transfer depends entirely on molecular energy interchanges, or the flow of valence electrons in a conducting medium.

Convection heat transfer is dependent on the motion of a fluid.

Radiation heat transfer does not depend on a material medium, however. It takes place by means of electro-magnetic waves that are propagated with a velocity comparable to that of light.

Conduction Heat Transfer

Conduction heat transfer may be defined as the transfer of energy caused by a temperature difference between parts of a system, or between two systems in direct contact. Direction of the heat transfer must be from the region of higher temperature, or *source*, to the region of lower temperature, or *sink*, in accordance with the second law of thermodynamics.

The quantitative law of heat conduction was formulated in 1822 by Fourier as a generalization of his experimental investigations.

Some very important limitations are imposed on the use of Fourier's equation, however. Heat transfer is considered in one direction, **x**, only. All heat transferred to the substance in a given time interval leaves the substance in the same time interval in a manner analogous to steady flow.

These conditions are readily met in the ideal case. For a slab of finite thickness and area, and a finite temperature difference, however, Fourier's equation must be regarded as an approximation. This is because heat transfer is not, strictly speaking, one dimensional.

Many common engineering problems in conduction heat transfer can be solved by Fourier's equation when one-dimensional steady-state heat transfer is approximated and the thermal conductivity is substantially constant. Under these conditions, the equation can be integrated to yield the simple equation

$$q = \frac{\bar{k}A(T_a - T_b)}{x_b - x_a} = \frac{\bar{k}A\Delta T}{\Delta x} \qquad (1)$$

The negative sign on **k** is introduced to indicate that heat transfer is in the direction of decreasing temperature.

Conduction Through Walls

Equation (1), subject to its limitations, may be applied to conduction heat transfer through homogeneous or laminated flat plates and homogeneous or laminated tube walls as follows:

1. *Homogeneous flat plate.* Eq. 1 may be applied directly.

2. *Laminated flat plate.* Eq. 1 may be applied in series to the layers of a laminated flat plate to determine the heat transfer rate. The plate may be composed of layers of the same or different materials. Referring to fig. 1, it follows from the condition of steady-state heat transfer that the heat transfer rate through each layer must be the same. Therefore,

$$q = \frac{k_{ab}A(T_a - T_b)}{(\Delta x)_{ab}} \quad \text{(for layer ab)}$$

$$q = \frac{k_{bc}A(T_b - T_c)}{(\Delta x)_{bc}} \quad \text{(for layer bc)}$$

$$q = \frac{k_{cd}A(T_c - T_d)}{(\Delta x)_{cd}} \quad \text{(for layer cd)}$$

$$T_a - T_b = \frac{q(\Delta x)_{ab}}{k_{ab}A}$$

$$T_b - T_c = \frac{q(\Delta x)_{bc}}{k_{bc}A}$$

$$T_c - T_d = \frac{q(\Delta x)_{cd}}{k_{cd}A}$$

NOMENCLATURE

A	=	area	ft.²
k	=	thermal conductivity	Btu. ft./hr. ft.² °F
L	=	length	ft.
ln	=	natural logarithm	—
q	=	rate of heat transfer	Btu./hr.
r	=	radius	ft.
T	=	temperature	°F
x	=	length of heat flow path	ft.

Adding these three equations and solving for q, we get

$$q = \frac{A(T_a - T_d)}{\frac{(\Delta x)_{ab}}{k_{ab}} + \frac{(\Delta x)_{bc}}{k_{bc}} + \frac{(\Delta x)_{cd}}{k_{cd}}} \qquad (2)$$

Example: An electric furnace has a laminated wall composed of 9 in. of refractory brick ($k = 1.2$), 6 in. of insulation ($k = 0.1$), and 4 in.

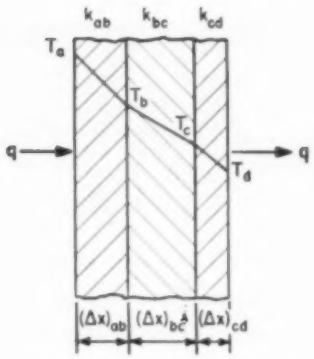

Fig. 1 — Heat transfer through a laminated flat plate.

of red building brick ($k = 1.0$). Inner and outer surface temperatures of the wall are 1600°F and 120°F respectively. The units of the thermal conductivities are Btu. ft/hr. ft².°F. If wall surface area is 20 ft², calculate the heat transfer rate.

Solution: From eq. 2,

$$q = \frac{20\,ft^2(1600-120)°F \times 12\,in./ft}{\left(\frac{9}{1.2} + \frac{6}{0.1} + \frac{4}{1.0}\right)\frac{in.}{Btu\ ft/hr\ ft^2\ °F}}$$

$$q = 4970\ Btu/hr.$$

3. *Homogeneous tube wall.* Fig. 2 shows a homogeneous tube wall of inner radius r_i and outer radius r_o. Corresponding wall temperatures are T_i and T_o and temperature is assumed to vary only with radial distance from the axis. That is, the temperature gradient is wholly in the radial direction. Heat transfer rate across a cylindrical surface of radius r and length L, from eq. 2, is

$$q = -k\,2\pi rL\frac{dT}{dr}$$

where dT/dr is the temperature gradient at radius r. From this we can derive

$$q = \frac{2\pi kL(T_i - T_o)}{\ln(r_o/r_i)} \qquad (3)$$

4. *Laminated tube wall.* Eq. 3 may be extended to the radial heat transfer through a laminated tube wall by methods similar to those employed for the laminated flat plate. Considering a tube wall made up of two layers, as shown in

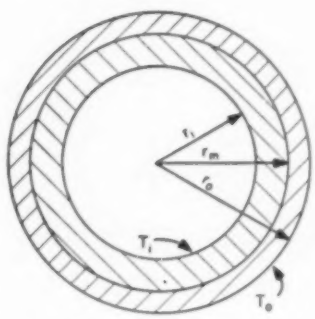

Fig. 3 — Heat transfer through a laminated tube wall.

fig. 3, heat transfer through each layer is obtained from eq. 3 for a tube of length L as follows:

$$q = \frac{2\pi k_{im}L(T_i - T_m)}{\ln(r_m/r_i)} \quad \text{(for inside layer)}$$

$$q = \frac{2\pi k_{mo}L(T_m - T_o)}{\ln(r_o/r_m)} \quad \text{(for outside layer)}$$

from which

$$T_m - T_o = \frac{q\ln(r_o/r_m)}{2\pi k_{mo}L}.$$

Adding, and solving for the heat transfer rate, we obtain

$$q = \frac{2\pi L(T_i - T_o)}{\frac{\ln(r_m/r_i)}{k_{im}} + \frac{\ln(r_o/r_m)}{k_{mo}}} \qquad (4)$$

This equation also may be extended to apply to any

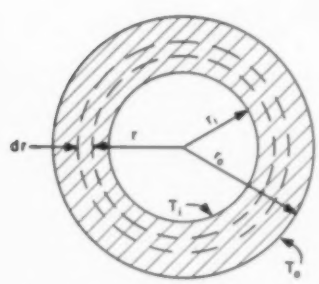

Fig. 2 — Heat transfer through a homogeneous tube wall.

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ROTOJET Model C-525 Air-driven Motor with swing-frame head and universal joint.

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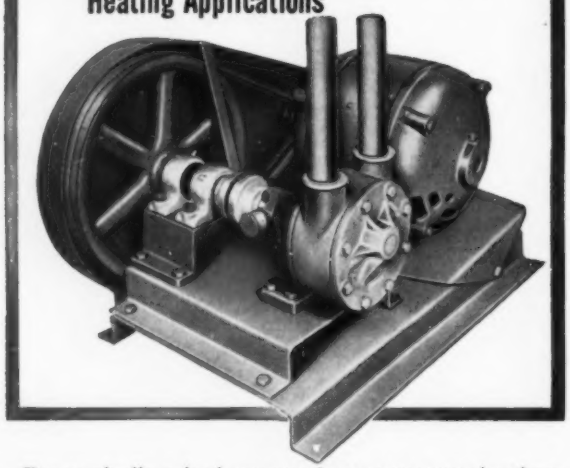
Circle 1672 opposite last page

new

TUTHILL SU PUMP UNIT

- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

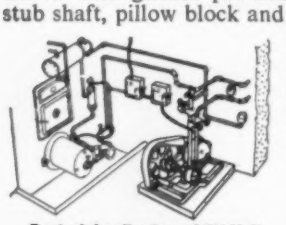


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

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951 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME_____ COMPANY_____
TITLE_____
STREET_____
CITY_____ STATE_____

TUTHILL PUMP COMPANY
951 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE!

Circle 1673 opposite last page

number of layers.

Example: A 6-in. steel pipe has an inside diameter of 5.761 in. and an outside diameter of 6.625 in. It is covered with a 1-in. layer of asbestos insulation. Thermal conductivities of the pipe material and the insulation are 25 and 0.13 Btu.ft/hr. ft².°F respectively.

If inside-surface temperature of the pipe is 500°F and outside-surface temperature of the insulation is 90°F, what is the heat transfer rate from 20 ft of pipe?

Solution: Inside diameter d_i is 5.761 in. Outside diameter d_o is 8.625 in., and diameter of the interface, d_m, is 6.625 in. From Equation (4), substituting the diameter ratios for the radius ratios, we get

$$q = \frac{2\pi \times 20\,\text{ft}\,(500-90)^\circ\text{F}}{\frac{\ln(6.625/5.761)}{25\,\text{Btu.ft/hr.ft}^2\,^\circ\text{F}} + \frac{\ln(8.625/6.625)}{0.13\,\text{Btu.ft/hr.ft}^2\,^\circ\text{F}}}$$

$$q = 25{,}800\ \text{Btu/hr.}$$

◆

"I said hand me the torch . . . over the top, stupid!"

RANNEY METHOD

takes FULL management responsibility AS IT SOLVES YOUR WATER PROBLEM

Now, the men at Ranney offer a complete "package plan" to handle every phase of any water supply project. The Ranney men and the Ranney Method combine to provide a WATER program for every industry and community *plus* . . . FULL MANAGEMENT RESPONSIBILITY.

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Circle 1674 opposite last page

NEW DEVELOPMENTS

Smaller network transformers for new squeeze play

Cutting network transformer height by 9 to 12 inches saves money on new vault construction and permits more capacity in existing vaults. Smaller size transformer increases space between tank and flat-panel radiators to give better heat dissipation in same amount of space. Transformers come in three-phase ratings from 300 to 1000 kva in 15-kv class.

Redesign of 750 kva transformer cuts height to 63"

Improved grain orientation of core steel and a new laced-core design permit a smaller core-and-coil for same kva output. Core-and-coil unit has more balanced thermal design and lower heat gradient. All parts work uniformly without raising temperature at hottest spot — so insulation lasts longer.

Throat connections for network protectors are lowered from 3 to 15 inches to keep protectors in all ratings and even protector bushings in most ratings below level of transformer top.

New design permits raising transformer off floor in vaults subject to flooding.

(Vault-Master transformers are a product of the General Electric Co., Schenectady 5, New York.)
Circle 1675 opposite last page.

All combustion controls in one neat package

Package boiler control system consists of completely piped and wired free-standing control panel with all instruments and controls for automatic operation of single burner gas and/or oil fired boilers. Use with either package or field-assembled boilers from small 6000 to 10,000 lb/hr generators to 60,000 to 100,000 lb/hr boilers.

All switches for manual-automatic control of system operation together with indicating lights and pushbuttons are placed on small console 33 inches from floor. Electric components, including automatic programming control, fan starter, relays, and terminal strips, are beneath console and are readily accessible from panel front. Control and shutoff valves, pressure switches, etc. are all wired at factory.

Only electricity, fuels, and steam need be directed through control panel before reaching boiler, so field piping, and wiring are held to a minimum.

Free-standing panel is 7 feet high, 5 wide

Control system includes all safety and limiting devices for start-up, shutdown, and on-line firing.

(Package Electric Combustion Control Systems are built by The Hays Corporation, Michigan City, Ind.)
Circle 1676 opposite last page.

Preheats liquids stored in bulk storage tanks

Oil preheater heats heavy liquids in bulk tanks — before they enter suction lines. Ideal for heating No. 5, No. 6, and Bunker C oils.

Shell and coil assembly is lowered into tank through manhole. Inlet and outlet pipes carry steam or hot water. Flow accumulator makes oils or other liquids flow over heated pipes before they enter suction line.

Preheater is built in two sizes: 16 in. dia for manholes with 16½ inch opening or larger; 14 in. dia for manhole openings from 14½ to 16 inches.

Pipes are furnished in right length for any size tank. Coil is 1½ inch full-weight steel pipe extending the depth of shell.

(Hot-Spot preheater is built by Rempe Co., 340 N. Sacramento Blvd., Chicago 12, Ill.)
Circle 1677 opposite last page.

For more information on items reported in the New Developments section, circle corresponding numbers on reader service card opposite last page.

Midget copy machine at budget price

Tiny office copy machine is priced at $100. Makes up to five copies of any typed, drawn, written, or printed material sized to 8½ by 11 inches. Also makes intermediates or masters for diazo printers and for producing offset masters for office duplicators.

Photocopy machine has curved glass platen

Overall machine dimensions are 13¼ by 17⅞ inches. Machine operates at about 2½c per copy.

(Verifax Bantam Copier is made by Eastman Kodak Co., Business Photo Methods Div., Rochester 4, N. Y.)
Circle 1678 opposite last page.

Detectors cut danger from spot fires

Three fire detectors can spot fire in earliest stages by rate-of-temperature-rise, fixed temperature, or both — triggers alarm to close doors or windows, stop machinery.

Spot fire detectors carry insurance officials' OK

Units are self-resetting. Testing does not require replacement of any part.

Three types are available:

- First type operates on both

fixed temperature and rate-of-temperature-rise. Protects 2500 sq ft. Units are spaced on 50-foot centers.

• Second type sounds alarm when fixed temperature is reached. Units are spaced on 15-foot centers. Cover 225 sq ft.

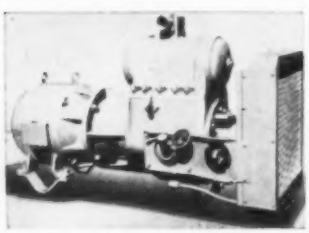
• Third model reflects any temperature rise over 15°F. Spaced on 30-foot centers to protect 900 sq ft.

All three detectors may be mounted on flat surface or in 3¼-inch outlet box. Actual detector size is 3⅝ in. dia by 2-5/32 inches deep.

(Fyrindex detectors are a product of J. H. Scharff Inc., Belleville, N. J.)
Circle 1679 opposite last page.

125-psi air compressors are lightweight, quiet

Industrial stationary rotary compressors are lightweight, vibration free, compact, and do not need special foundations.



40-hp unit (above) is 68 in. long, 39 high. Weighs 1365 lb.

Sized from 20 to 125 hp, units operate at 125 psi. Either air- or water-cooled oil coolers available. No exposed belts or couplings — units are completely enclosed.

(Davey Hydrovane rotary compressors are manufactured by Davey Compressor Co., Industrial Division, Kent, Ohio.)
Circle 1680 opposite last page.

Stop crying over diesel exhaust!

New technique indicates good results in chasing out an old bugaboo — diesel fumes that make everyone around cough, choke, and weep.

Treatment, already tested extensively on diesel-powered buses, can be used on stationary engines and other diesel-powered equipment as well.

Technique forces pressurized air from diesel engine supercharger through a chemical compound that reacts with uncombusted byproducts in

Neutralizer unit eliminates need for high stacks on diesel trucks

air stream. Irritating properties are neutralized so that they become completely inactive.

Purified air may then be given a fresh, outdoorsy odor before it is discharged through exhaust pipe.

Air clean-up system does not reduce diesel power output in any way. Is effective even when diesels are working at top speed over a long period.

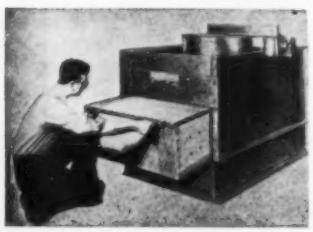
(Nodorizer neutralizer unit and Dieseleen neutralizer compound are products of Independence Chemical Co., Philadelphia, Pa.)
Circle 1681 opposite last page.

"Shorty" cooling tower cools 15 to 200 gpm

Compact design of low-silhouette cooling tower is achieved with multi-finned internal decking that exposes four times as much water to air as conventional models. Notched plastic sheets in internal decking are of specially compounded plastic.

Units measure 44 to 84 inches high, depending on capacity (15 to 200 gpm).

Gravitational flow carries water from tower top down over plastic decks. Decks are mounted in two pull-out



Routine maintenance can be done in minutes rather than hours

drawers for easy inspection and cleaning.

All tower's metal parts are hot-dip galvanized after assembly to eliminate need for painting or other protection. Fan is mounted between the two decking units.

(Low-silhouette cooling tower is made by Binks Manufacturing Co., 3122 West Carroll Ave., Chicago 12, Ill.)
Circle 1682 opposite last page.

Reducers are lined with Teflon

Reducing flanges with Teflon lining give exceptional corrosion protection and chemical inertness. Integral asbestos backing eliminates

Lined reducing flange eliminates piping trouble spot

need for separate gaskets.

Material being conveyed cannot touch metal anywhere in reducing-flange assembly, eliminating chance of contamination by corrosive products.

Possibility of damaging reducer lining by thermal shock is eliminated. Forming process keeps liner semi-flexible to compensate for thermal expansion and contraction. Tapered flow passage minimizes turbulence.

Reducers withstand 150 psi and full vacuum at −100°F to 500°F. Come in 1- to 6-inch ASA pipe sizes.

(Fluoroflex-T Reducing Flanges are made by Resistoflex, Roseland, N. J.)
Circle 1683 opposite last page.

Recorder can house four receivers

Electronic recorder receives and records output from four remote ring balance meter-operated slide wires. Electronic receivers consist of amplifier, input box, servomotor, and slide wire.

Pen position is proportional to input quantity

Instrument can record fluid density, liquid level in open or closed vessels, boiler drum water levels, and temperature and pressure compensated fluid flow readings.

Available as an ac bridge, dc potentiometer or dc voltmeter, receiver converts incoming electric signals into corresponding pen positions for recorder and indicator.

Input box receives the incoming signal, then converts it to a specific drive signal.

Overall accuracy is 0.5% of full scale.

Optional accessories can adapt receiver for control system signals, slide wire output for logging systems, alarm

contacts and computing devices.

(Ring Balance Electronic Recorder is built by Hagan Chemicals & Controls, Inc., 323 Fourth Ave., Pittsburgh, Pennsylvania.)
Circle 1684 opposite last page.

Sheave permits wider speed range, ups hp

Single-groove S-section sheave has a range of 5.5 inches minimum to 120 inches maximum. Permits wider speed changes and increased horsepower transmitting capacity.

S-section belt has maximum width of 2-1/16 inches — but needs no more mounting space than R-section one groove sheave.

(S-section Vari-Pitch sheave is a product of Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.)
Circle 1685 opposite last page.

For more information on New Development items circle corresponding numbers on reader service card opposite last page.

Large induction motors produce to 1250 hp

Large induction motors (150 to 1250 hp) can power large process machinery such as refinery pumps, compressors, cooling-tower pumps, mixers, coal crushers, impact breakers.

Open drip-proof, splash-proof, enclosed, and explosion-proof enclosures available. Oil reservoir and sight gage for each sleeve bearing simplify maintenance. Wide range of insulations available to meet specific needs.

Optional features include bearing temperature detectors, breather plugs, space heaters, drain plugs on enclosed motors.

(These large induction motors are built by The Louis Allis Co., 427 East Stewart St., Milwaukee 1, Wis.)
Circle 1686 opposite last page.

This Bailey Control System helps cut fuel costs on a 70,000 lb per hr capacity 125 psi boiler in an industrial plant. Control drive in foreground regulates stoker.

How Bailey stretches your fuel dollar...

You can wring more energy out of a dollar's worth of fuel when you are getting optimum performance from your steam plant equipment. You get peak performance when Bailey Meters and Controls are on the job. They increase your plant efficiency.

Bailey is the choice of virtually all the most efficient plants on the Federal Power Commission's heat rate report. Here's why:

1. Complete Line of Equipment

You can be sure a Bailey Engineer will offer the right combination of equipment to fit your needs. Bailey manufactures a complete line of standard, compatible pneumatic and electric metering and control equipment that has proved itself. Thousands of successful installations involving problems in measurement, combustion, and automatic control are your assurance of the best possible system.

2. Experience

Bailey Engineers have been making steam plants work more efficiently for more than forty years. Veteran engineer and young engineer alike, the men who represent Bailey, are storehouses of knowledge on measurement and control. They are up-to-the-minute on the latest developments that can be applied to your problem.

3. Sales and Service Convenient to You

There's a Bailey District Office or Resident Engineer close to you. Check your phone book for expert engineering control on your steam plant control problems.

A132-1

BAILEY METERS

Instruments and controls for power and process

BAILEY METER COMPANY

1038 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

Circle 1687 opposite last page

"efficiency-engineered!"

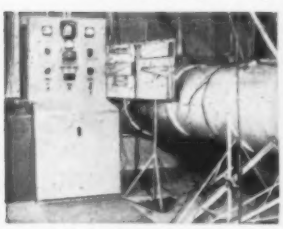
what does this mean to YOU?

IT MEANS AEROVENT FANS ARE INDIVIDUALLY "JOB-TESTED" FOR PERFORMANCE AND RATING!

One of the most complete facilities in the United States for scientific air-moving research is maintained by Aerovent.

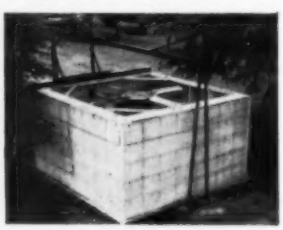
In addition to ceaseless experimental work, this up-to-the-minute engineering laboratory, with the aid of the world's largest test chamber (wind tunnel), tests Aerovent units under simulated operating conditions. Typical resistances which may be encountered in actual operation are applied to each unit, to assure satisfactory performance and economy in every industrial application.

Write for free Engineering Bulletin E-57



CONTROL BOARD

for observing and recording operating characteristics of fans being tested in chamber shown at top.



OUTDOOR LABORATORY

for confirming of wind tunnel tests and performance data, and conducting endurance test programs.

Aerovent builds fans for every type of industrial application, in sizes from 9" to 96", and capacities to 145,000 CFM. Large propellers for cooling towers and heat exchangers in diameters to 18 feet.

WORLD'S LARGEST exclusive manufacturers of industrial air-moving equipment!

Rated in accordance with Standard Test Code and U.S.D.C. Comm. Std. CS178-51.

Aerovent FAN CO. INC.

Ash and Boyd Sts. Piqua, Ohio

Circle 1688 opposite last page

Insulation was applied as a self-supporting four-inch outer wall of glass foam blocks. This gained the brewery time, solved a space problem too.

Unusual insulation technique puts plant in service — *Fast*

Problem: Recently, when the F. & M. Schaefer Brewing Company added three floors to Stockhouse "F" at their Brooklyn, New York brewery, they needed the added capacity in a hurry.

Piles for the elevator structure were driven in December, and in January the first steel was delivered and erection started. As soon as steel and concrete work was completed, the third floor tanks were installed.

At this point, Schaefer wanted to refrigerate the space as quickly as possible so they could begin to age beer in the tanks. Also, the narrow space between the tanks and the wall made insulating the room after the outer brickwork was up almost impossible.

Solution: Both problems were solved at the same time through the use of a unique cellular glass insulation (Foamglas). The material, composed of millions of sealed glass cells, has an ultimate compressive strength of over 7 tons/sq ft and is impervious to moisture.

This rigidity and strength enabled Schaefer to erect a self-supporting wall of two layers of 2-inch blocks of Foamglas before the outer wall was ready. And, since the insulation does not lose efficiency if wet by outside weather conditions, the floor was put into operation immediately.

The three floors were completed ahead of schedule, tanks were filled with beer, and a copious supply was guaranteed for Eastern beer drinkers.

(Foamglas cellular glass insulation is manufactured by Pittsburgh Corning Corporation, One Gateway Center, Pittsburgh 22, Pa.)

Circle 1689 opposite last page.

Lighting transformer is 10 db below specs

Redesigned lighting transformers operate at exceptionally low noise level — some models are 10 to 12 db under NEMA standards.

Quieter operation is realized by eliminating gaps that allow vibration between adjacent surfaces. Other features: core wound of grain-oriented, high permeability cold-rolled steel for higher flux densities; large air ducts to control heat rise for greater overload protection.

Redesigned transformers weigh as much as 50% less than other comparable types. Transformers are rated 5 through 37½ kva.

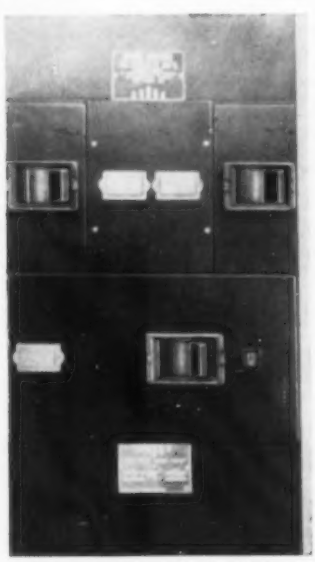
(Type W lighting transformers are built by Marcus Transformer Co., Inc., Rahway, N. J.)

Circle 1690 opposite last page.

Circuit breaker gets reducing treatment

Redesigned 400-amp molded-case circuit breaker permits space savings of up to 30% in panelboard, switchboard, and electric machinery components.

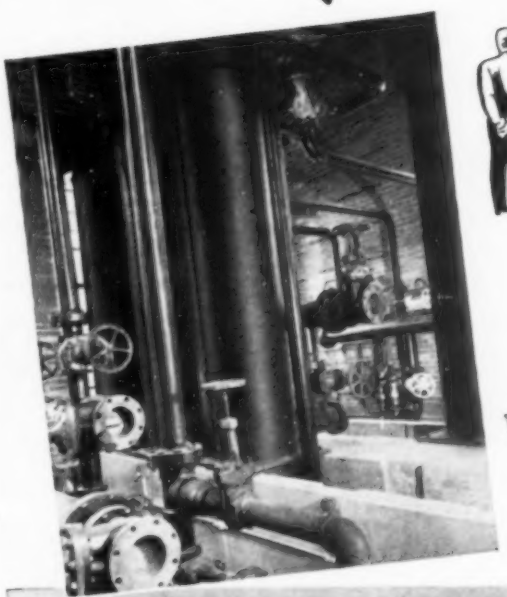
Features include adjustable magnetic trip that can operate over wide current range;



More circuits can be handled in less space

Dirty Water can't "Shut-down"...

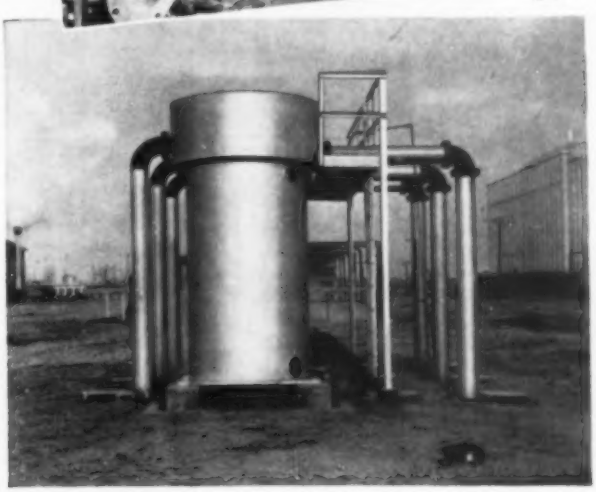
Vogt



film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request. Address Dept. 24A-XIP.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Sales Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, CAMDEN, N. J. CINCINNATI, ST. LOUIS, CHARLESTON, W. VA.

Circle 1691 opposite last page

Drive out

FOUL AIR

Blow in

FRESH AIR

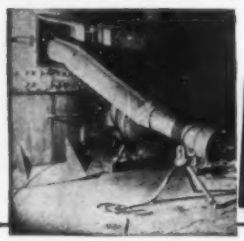
with Coppus Type A Ventilator

Assure greater safety, comfort for workers... get greater efficiency.

Drive out dangerous fumes, gases, stagnant or hot air from boilers, cable manholes, tanks, vats and other confined places. *Supply fresh air continuously.*

Send now for further information. Coppus Engineering Corporation, 184 Park Avenue, Worcester 2, Mass.

MANHOLES made safe for workers' entrance within minutes.



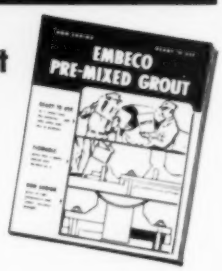
BOILER AND TANK INTERIORS cooled by Coppus. Fresh air supplied continuously.

ANOTHER **COPPUS** "BLUE RIBBON" PRODUCT

Circle 1692 opposite last page

GET THIS FREE GROUTING GUIDE

... before you Grout another piece of heavy equipment



Send for this *free* grouting guide which clearly illustrates 11 common machinery settings, methods of grouting and forming, and hot and cold weather grouting. Discussion covers proper mixing and placing of grout, reasons for using prepared, non-shrink grout, etc.

Products sold in Canada are Manufactured in Canada

The **MASTER BUILDERS** Co. Ltd.
Subsidiary of American-Marietta Company

95 INGRAM DRIVE TORONTO 9, ONTARIO

Circle 1693 opposite last page

quick make — quick break mechanism; thermal time delay; common trip action; corrosion resistant bearings; silverplated pressure lugs.

Circuit breaker is designed for applications now using J-, K-, and KL-frame sizes. UL-approved for all 2- and 3-pole ratings from 70 through 400 amps.

Interrupting capacities are 15,000 amps at 600 volts ac and 25,000 amps at 240 volts ac.

(NJ-400 circuit breaker is made by Federal Pacific Electric Co., 40 Paris Street, Newark 1, N. J.)
Circle 1694 opposite last page.

Read temp transmitter up to 20 feet away

Tiny indicating temperature transmitter for process control pneumatically transmits in range from 100 to 600°F. Upper portion of vapor pressure thermal curve is expanded over a 4½-inch scale for extra sensitivity, excellent readability.

Expanded scale also increases output pressure change per degree temperature change for increased receiver control action.

Transmitter mounts on wall or vertical pipe; weighs 10 pounds. Vapor pressure thermal system includes 4 by ⅜-inch bulb, 18-inch bendable bulb extension, polyvinyl plastic-covered bronze tubing.

(Indicating transmitter is made by The Foxboro Co., Foxboro, Mass.)
Circle 1695 opposite last page.

Aluminum connectors for high conductivity

Aluminum power connectors offer high electric conductivity when connecting tubing or tubing, cable to cable, tubing to cable or to terminal lug connections. Positive wrapping action gives low-resistance joint that vibration or strain won't loosen.

Connectors carry full rated conductor current with connector temperature rise not

Better Visual Warning

Double Range

Double Intensity

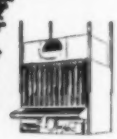
with the new Beacon Ray 271

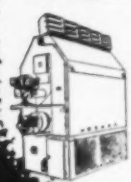
The adaptability and success of the 275 Beacon Ray created demand for an even more powerful and more rugged warning light. The new FEDERAL 271 Beacon Ray more than doubles the intensity and range of the original. It can mount on a 1" pipe or on a flat surface, it has a substantial cast aluminum housing and a heat resistant glass dome which houses a mechanism that rotates a single, powerful sealed-beam spot lamp. The hinged cover with single clasp, facilitates relamping and inspection. The 271 Beacon Ray is built for real service and full dependability!

FEDERAL SIGN and SIGNAL Corporation
8709 S. State St., Chicago 19, Ill.

Circle 1696 opposite last page

MODERN HEATING FOR INDUSTRY





Reznor gas heaters offer the efficient, economical answer to all these heating problems:

- complete heating systems for new buildings
- replacement of obsolete heating systems
- supplemental heating for trouble spots
- heating for auxiliary buildings
- heat for curing, drying and other process applications

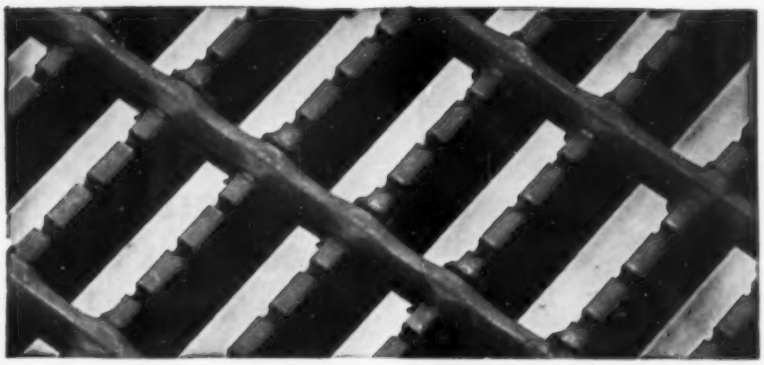
With suspended, duct and free-standing types in all appropriate sizes from 25,000 to 2,000,000 Btu, the Reznor line includes the equipment which is exactly right for YOUR plant heating job.

For complete details, write today for your copy of Bulletin GN-57 or give your nearby Reznor distributor a call. You'll find him listed under "Heaters-Unit" in the Yellow Pages.

REZNOR
WORLD'S LARGEST-SELLING DIRECT-FIRED
UNIT HEATERS

Reznor Manufacturing Company, 70 Union Street, Mercer, Pennsylvania

Circle 1697 opposite last page



New Slip-Proof Design makes

Gary SERRATED GRATING safest

WHERE GOOD TRACTION IS IMPORTANT

Indoors or out, for area gratings in sidewalks, inclined walkways, fire escapes—wherever safe-footing is important, this one-piece, resistance-welded grating will provide safer working conditions. It's tailor-made to your requirements. Write for descriptive Catalog PI-48

FREE SAMPLE
We'll send this handy paper weight if you request it on your company stationery.

ROCKWELL SPRING & AXLE CO.
Gary Grating Division
4000 EAST SEVENTH AVE., GARY, INDIANA

Circle 1698 opposite last page

NON-FLUID OIL
TRADE MARK REGISTERED

BEST FOR PRESSURE APPLICATION

Some lubricants work satisfactorily at one temperature or pressure, but when conditions vary they separate, form gummy residues or lose their lubricating ability.

NON-FLUID OIL, however, maintains its original consistency and lubricating properties regardless of speed, temperature or pressure changes. Long lasting and strictly neutral, NON-FLUID OIL contains nothing of a residual nature that can clog fittings and cause bearings to run dry.

Try it in your pressure system or gun. Send for a free testing sample of NON-FLUID OIL and informative Bulletin No. 522 and discover why it rates highest in industry.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
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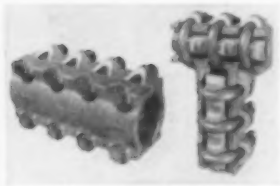
Greensboro, N. C.
Detroit, Mich.
Providence, R. I.
St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 1699 opposite last page



Connectors give solid joint that can't loosen

exceeding that of conductor. Recessed bolt heads permit single-wrench assembly and disassembly.

(Aluminum power connectors are available from Delta-Star Electric Div. of H. K. Porter Co., Inc., 2437 Fulton St., Chicago 12, Ill.)
Circle 1700 opposite last page.

Tank cleaner scrubs inside big tanks

High capacity water-driven tank cleaner scrubs interior of large tanks.

Two revolving jets shoot up to 50 feet each in a spherical pattern. Uses cold water or

Tank cleaner operates on existing water lines

hot water to 176°F. Cleaner uses existing pumps and water lines to drive jets — needs only 114 psi to operate.

Discharges up to 9400 gph. Oil-lubricated unit is in sea-water-proof housing.

(Jumbo tank cleaner is made by Sellers Injector Corp., 1602A Hamilton Street, Philadelphia 30, Pa.)
Circle 1701 opposite last page.

X MARKS THE CRITICAL SPOTS!

It takes more than muscles to build a storage bin

Before the physical work of building a bin begins, we must know the problems involved at the *Three Critical Points.*

X What is the loading problem?
X What are the characteristics of the material to be stored . . . and its "flowability"?
X What is the volume and rate of discharge?

When planning your next storage bin, may we sit in on the very early stages of planning?

NEFF & FRY COMPANY
310 Elm St., Camden, Ohio

N&F *You can always spot a Neff & Fry Bin by the shape of the stave!*

Circle 1702 opposite last page

a good team for steam

This Yarway team has scored high—over a million installed on all types of steam equipment. Stocked and sold by 270 Industrial Distributors. For free Steam Trap Book, write YARNALL-WARING CO., 100 Mermaid Ave., Philadelphia 18, Pa.

go YARWAY with confidence

Circle 1703 opposite last page

Supercharged gas engine with turbocooler.

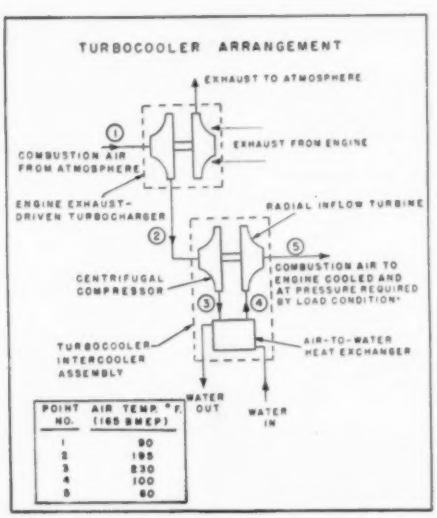
Pulls more engine hp . . . with less fuel

Turbocooler installs on new or existing gas and gas-diesel 4-cycle engines to provide supercool combustion air. Field tests show that turbocooled combustion air increases hp output as much as 23 percent, cuts fuel consumption by 5 percent.

Turbocooler is a turbine-driven centrifugal compressor equipped with aftercooler. Cooling cycle brings filtered air into the high-pressure turbocharger for compression by exhaust-gas-driven centrifugal blower. Booster in turbocooler compresses air further.

Air-to-water intercooler then cools air before it enters a turboexpander. Since pressure of air entering turboexpander is greater than engine air intake requirements, pressure drop through expander spins impeller. As air expands through impeller it is cooled 15 to 40 degrees before it enters combustion chamber.

(Turbocoolers are a development of The Cooper-Bessemer Corp., Mt. Vernon, O.) Circle 1704.



NATIONAL AIROIL

Oil Burners

OF THE STEAM AND MECHANICAL TYPES NOW COMBINED INTO

Dual Stage BURNERS

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

46 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

Established 1912 — *Incorporated 1917*

NATIONAL AIROIL BURNER COMPANY, INC.

1350 E. Sedgley Ave., Philadelphia 34, Pa.
S. W. Division: 2512 So. Blvd., Houston 6, Texas

Circle 1705 opposite last page

NEW LITERATURE

Reviews of books and industrial bulletins describing equipment, supplies, services

Quick way to calculate pressure drop, velocity

Graphs in 56-page catalog simplify calculation of pressure drop, discharge and velocity of liquids. Pressure conversion chart is scaled from 0 to 3000 psi. Catalog also gives tables of dimensions on standard, extra strong, and double extra strong steel pipe. Handy section lists common valve maintenance problems and their solutions.

Catalog gives complete engineering data on self-aligning, self-sealing valves for control of extreme pressures.

(Catalog 58-59 is by Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.)
Circle 1706 opposite last page.

Coal: Its role in U. S. and European industry

Reviews coal production in coal-rich southern West Virginia, eastern Kentucky, and southwest Virginia. Tells by text and photograph the story of coal from the mine to its destination — often an industrial area of Europe.

(Bulletin "Coal Bin for the World," 32 pages, is available from the Chesapeake and Ohio Railway, Terminal Tower, Cleveland, Ohio.)
Circle 1707 opposite last page.

Jacketed piping systems keep materials flowing

Eight-page bulletin describes standard jacketed piping systems to keep normally sticky, solid, or semi-solid materials hot enough to flow readily. Heat for system may be supplied by steam, hot water, hot oil, or synthetic gases.

Heating medium circulates throughout outer jacket wall. Product is pumped or flows by gravity through system.

Bulletin describes all system components: fittings, valves, pumps, strainers, meters, pipe, flexible hose. Valves and fittings in cast iron handle pressures to 150 psi at 450°F.

Other materials are available for high temperatures or special service conditions.

Jacketed piping systems are also adaptable for cooling, with cold water or brine as cooling medium.

(Bulletin J-57 is available from Hetherington & Berner Inc., 701-745 Kentucky Ave., Indianapolis 7, Ind.)
Circle 1708 opposite last page.

Gives glass block uses

New 32-page bulletin introduces colored glass blocks, new use of glass block for curtain walls. Written as reference manual for architects, engineers, builders, bulletin gives background data on glass blocks.

It also contains useful information on light transmission, insulation values, accessory materials, complete specifications. Physical performance data simplifies selecting proper type of block.

(Booklet GB-108 is offered by Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.)
Circle 1709 opposite last page.

Handy design index to ASME code

Important design data in ASME Boiler and Pressure Vessel Code are indexed in handy reference folder. Makes it easy for pressure vessel designers, purchasers, and operators to locate references quickly in the Code. Four-page index is printed on card stock for durability. Size (8½ by 11 inches) and 3-ring punching make it fit either standard-size notebook or file drawer.

Cross section sketch of boiler and components also carries specific references to each pertinent section in Code.

(ASME Code Index, Bulletin CI, is published by Downingtown Iron Works, Inc., Downingtown, Pa.)
Circle 1710 opposite last page.

Pipe insulation — how to choose

Handy sliding guide enables quick and easy selection of most economical pipe insulation thickness. Gives insulation surface temperature and Btu loss for various insulation thicknesses on 1- to 24-in. dia pipe for temperatures from 300 to 1200°F. Pocket-size guide is plastic coated for long life.

(Fact Finder insulation guide is being offered by Union Asbestos & Rubber Co., 1111 West Perry Street, Bloomington, Ill.)
Circle 1711 opposite last page.

Condensate corrosion cut by amine

Shows how filming-type amine controls corrosion in steam condensate systems. Other benefits include removing iron oxide deposits, increasing heat transfer, cutting maintenance and replacement costs, and protecting steam condensate systems when on standby service.

Corrosion reduction chart made up from results of 30-day controlled tests shows how amine reduced corrosion in 10 different applications.

(Four-page bulletin 410 on Hagafilm and Hagamin is available from Hagan Chemicals & Controls, Inc., Hagan Bldg., Pittsburgh 30, Pa.)
Circle 1712 opposite last page.

Cuts unit water content with cement admixture

Case histories show how concrete admixture improves cement quality, wearing ability. Additive controls unit water content, entrained air, placing consistency, hardening rate.

Specially mixed concrete is estimated to be 400% more resistant to weathering than untreated concrete.

(Bulletin MBR-P5, 20 pages, on Pozzolith concrete is available from The Master Builders Co., Cleveland 3, Ohio.)
Circle 1713 opposite last page.

Describes transformer designs and features

Describes power, unit substation, secondary network, industrial, furnace, distribution, and instrument transformers. Bulletin gives full construction and design features on each transformer; reviews applications for each type.

(Bulletin 61B6186C, 20 pages, is available from Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.)
Circle 1714 opposite last page.

Zone-by-zone cooling — efficient, costs less

Bulletin describes independent air conditioners that give zone-by-zone air-conditioning control. According to 8-page bulletin, independent air conditioners are simpler to

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Circle 1715 opposite last page

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Circle 1716 opposite last page

install — no need to shutdown plant or office while central unit, ducts, and vents are installed.

Independent units also permit individual control. Each unit may be adjusted to handle specific conditions met in area it services. At night or weekends, only conditioners in areas that are not closed down need be operating.

(Bulletin SP-79-3811 is available from General Electric Co., Air Conditioning Div., 5 Lawrence St., Bloomfield, N. J.)
Circle 1717 opposite last page.

Standardize worm gear for matched sets

Standard gear sets described in 16-page bulletin are individually matched to be sure of perfect fit between mating worm and gear. Standardization simplifies gear ordering by eliminating gear design and calculations for bearing sizes and location.

Worms have either single- or double-extended shaft.

Bulletin gives specification drawings for all worms and gears, tool charts and hp ratings for gearset combinations, backlash tolerances, lubrication data.

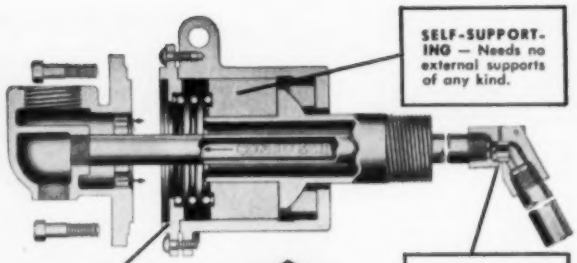
(Bulletin 700-C is available from Cone-Drive Gears Div. of Michigan Tool Co., 7171 East McNichols Rd., Detroit 12, Mich.)
Circle 1718 opposite last page.

Power regulators have hanging tap changer

Describes single-phase power regulators that are redesigned to permit suspending tap-changing mechanism and transformer from regulator cover. This allows continuous leads to pass directly from transformer coils to double-bolt terminals on dial switch.

New design makes possible replacing tap-changing mechanism and transformers without disconnecting leads or removing terminals.

Other new power regulator features described in 16-page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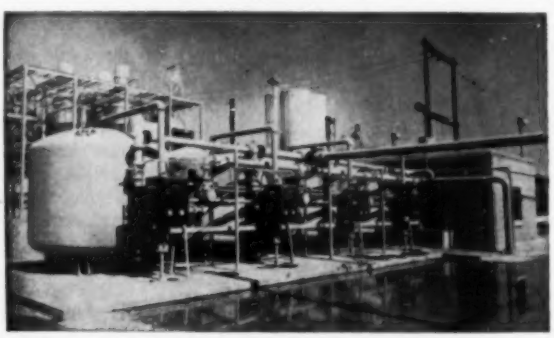

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Circle 1720 opposite last page

bulletin include control equipment on single chassis and enclosed in weather-type cabinet; horizontal position indicator that permits 25 regulating combinations.

New regulators are rated at 2500, 5000, and 7620 volts; give ±10% regulation.

(Bulletin 21B6065D is available from Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.)
Circle 1721 opposite last page.

Gives complete specs on armored cable

Interlocked armored cable for handling 600 volts, 5000 volts, 15,000 volts grounded neutral, and 15,000 volts ungrounded neutral are described in 12-page bulletin. Gives data on installation, moisture resistance, toughness, ampacity, space needs.

Tables give AWG or MCM size, number of strands, insulation thickness, diameter (both under and over armor), net weight, and current ampere ratings for each size.

Cutaway sketches show how to terminate cables and make joints for Rozone A insulation. Bulletin is punched to fit standard 2- or 3-ring notebook.

(Bulletin RCP 730 is available from Rome Cable Corp., Rome, N. Y.)
Circle 1722 opposite last page.

Data book covers water diagnosis, pollutants

Fully indexed bulletin describes meaning and method of expressing common water quality criteria and potential pollutants.

Designed to allay misunderstanding and misconceptions that exist in the water treatment field, it is written for both the technical person and for management.

Pertinent topics discussed included acidity, alkalinity, chlorides, coliform bacteria, oxygen, pH, solids. Glossary and bibliography included.

(Bulletin 58, "The Meaning, Significance, and Expression of Commonly Measured Water Quality Criteria and Potential Pollutants," 46 pages, is available from Louisiana State University and Agricultural and Mechanical College, Baton Rouge, La. $1.75 the copy.)

Unit heaters heat when you need it

Describes direct-fired unit heaters that furnish the amount of heat you need where you need it — around windows, entrances, warehouse doorways, hard-to-heat factory areas.

Suspended, duct, and free-standing types supply from 25,000 to 2 million Btu. Heaters install quickly, need little maintenance.

(Bulletin GN-57 on direct-fired unit heaters is available from Reznor Manufacturing Co., 70 Union St., Mercer, Pa.)
Circle 1723 opposite last page.

For more information on items reported in the New Literature section circle corresponding numbers on reader service card opposite last page.

Cut-in valve will open emergency water main

Four-page bulletin describes cushioned emergency cut-in valve that automatically opens emergency water supply if normal water supply fails. Includes schematic drawings of installation, other dimension data.

(Bulletin W-14 is available from Golden-Anderson Valve Specialty Co., Pittsburgh 33, Pa.)
Circle 1724 opposite last page.

Central lube system can work for you

Bulletin tells how to apply centralized lubrication to your equipment. Describes basic system components. Gives tips on analyzing machine bearings to determine sizes and types that must go into system layout. Tells how to choose lubrication intervals, pump and accessories, appropriate lubricant.

Tables give properties and application data for various grades of oils and light greases over temperature range of 0 to 70°F Minimum.

(Bulletin 34-28A is available from Alemite Division of Stewart-Warner Corp., Chicago 14, Ill.)
Circle 1725 opposite last page.

How boiler bean valve stops blow-off waste

Two page data sheet describes continuous blow-off valve for accurate regulation of boiler blow-off. Includes piping arrangement for bean valve and instructions for changing orifice bean and rate of flow. Six interchangeable orifice beans come with each valve.

(Bulletin 500 is available from The Uniblow Valve Co., 1920 West 77th St., Cleveland 2, Ohio.)
Circle 1726 opposite last page.

Rotary car dumper dumps in 1 minute

Bulletin describes new rotary car dumper for hopper and gondola cars. Dumper can dump and return a spotted car in one minute. Optional equipment includes electronic scale in dumper platen and power-operated car retarder to permit spotting rolling cars without riders. Sixteen pages.

(Bulletin 957 is issued by Heyl & Paterson, 55 Fort Pitt Blvd., Pittsburgh 22, Pa.)
Circle 1727 opposite last page.

Handy data for users of dc contactors, relays

Selection and application data in 32-page bulletin covers general purpose contactors, mill-type contactors, time-delay contactors, general purpose relays, timing relays, instantaneous-over-

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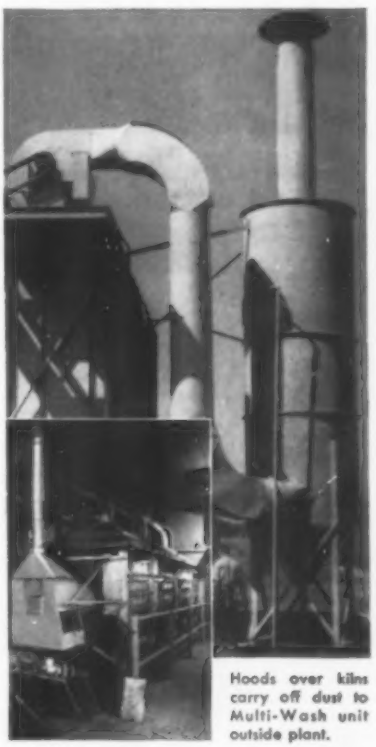

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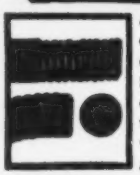

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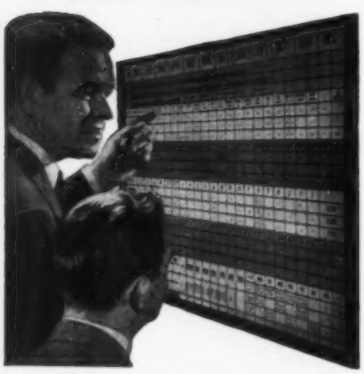

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Circle 1730 opposite last page

load relays, thermal-overload relays, field-loss relays, field accelerating and decelerating relays, and high dropout relays. Includes ordering instructions, product descriptions, photographs, technical data.

(Bulletin GEA-6621 is offered by General Electric Co., Schenectady 5, N. Y.)
Circle 1731 opposite last page.

Titanium fittings for nuclear systems

Describes titanium fittings for nuclear piping systems and critical service in chemical processing industries.

Fittings are impervious to attack by corrosive salts at moderate temperatures and give greater latitude in tensile strength, fatigue resistance, and ductility.

("Titanium Moves into Process Equipment" is available from Ladish Co., 5400 Packard Ave., Cudahy, Wis.)
Circle 1732 opposite last page.

Lightning arrestors on transformers

Bulletin includes impulse sparkover and discharge voltage tables for intermediate class lightning arrestors. Type F arrestors come in 20, 25, 30, 37, 40, 50, 60, and 73 kv. Will mount directly on transformers and other substation equipment.

Bulletin LA4 is issued by Line Material Industries Div., McGraw-Edison Co., Milwaukee 1, Wis.)
Circle 1733 opposite last page.

Case histories review plant boiler control

Complete boiler control systems for large utility power stations are described, with Pennsylvania Electric Co.'s new 900,000 lb/hr unit at Seward Station as an example.

Describes components for combustion, fuel cutback, pulverizer temperature, feedwater, feed pump recirculation, automatic sequential soot-blowing systems. Schematic diagram shows hook-up of all components from primary controlling elements to pneumatic regulating actuators.

(Bulletin 1038, 12 pages, is available from Copes-Vulcan Div., Blaw-Knox Co., Erie, Pennsylvania.)
Circle 1734 opposite last page.

Data on digital system for process control

Data in 8-page bulletin includes specifications on new digital control system for machine tool positioning and for process control. Also describes shaft-mounted positioning gearmotors for valves, drives, pumps.

(Bulletin J-101 is available from The Jordan Co., Inc., 3235 West Hampton Ave., Milwaukee 9, Wis.)
Circle 1735 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite last page.

Describes two valves for heat exchangers

Steam regulating valves described in 6-page bulletin have pilots for both fast and slow heat exchangers. Selection tables and line drawings show pilots in typical applications.

Fast-heating exchangers for which valves are designed in-

continued on page 39

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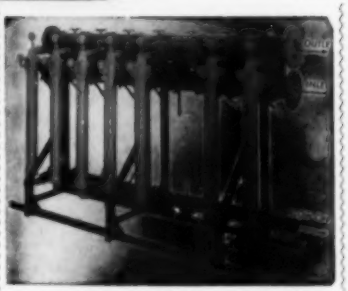

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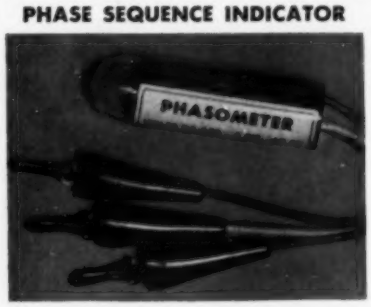

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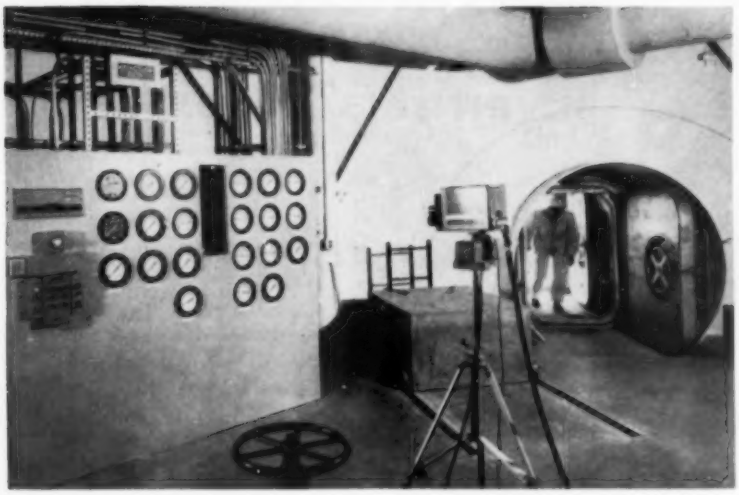
Circle 1737 opposite last page

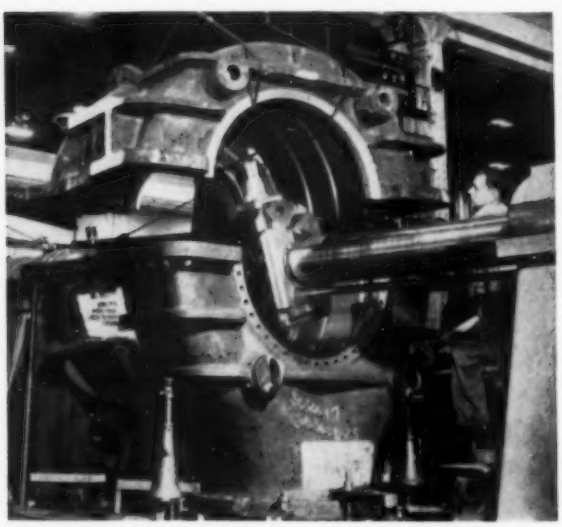
PHOTO NEWS



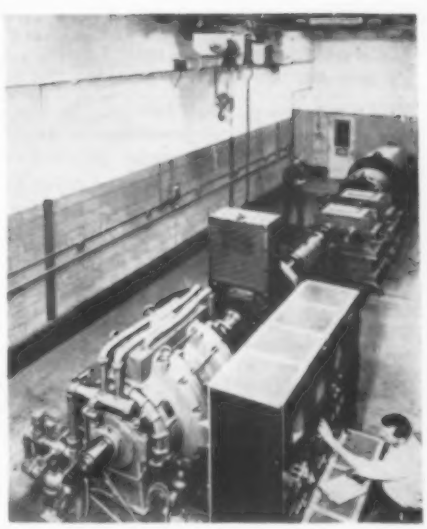
Vallecitos boiling water reactor uses a General Electric closed-circuit television system to monitor recording instruments inside reactor enclosure for benefit of operator in another building. Steam from reactor powers a Pacific Gas & Electric turbogenerator installation.

One of the most complex, compact, and accessible piping systems was recently engineered and installed for Jones & Laughlin Steel Corp. at its Cleveland Works by the Power Piping and Sprinkler Division of Blaw-Knox Company. System will supply heat control, lubrication, and operating control for sheet rolling mill.

Mr. Joseph G. Jackson, past president of Engineers' Club of Philadelphia, accepts a plaque commemorating the fiftieth anniversary of the founding of AIChE at the club. Dr. George E. Holbrook (left), president of AIChE, presents the plaque, while Dr. Frederic Dannerth (Textile Research Laboratory), a charter member, looks on.



Two halves of huge Carrier Corporation centrifugal compressor have been bored simultaneously. This insures hairline clearance required for impellers spinning inside at speeds in excess of 900 ft/sec. Compressor will weigh 35,000 pounds when fully assembled and will discharge some 30,550 cu ft/min of hydrocarbon mixture for refining process at Magnolia Petroleum Company, Beaumont, Tex.



Twin Disc Clutch Company's new research and development laboratory at Rockford, Ill., has 1000-hp dynamometer bay. Automatic test machine is instrumented with Baldwin SR-4 devices, which permit direct plotting of performance curves in less time than it would take to fix a single point using conventional point-by-point dynamometer.

This Is You continued from page 11

tional beliefs may lead to confusion and disorder.

The income level of the students is significantly related to the attitude towards scientists.

In almost every item, low-income students expressed a significantly less favorable opinion than middle-or high-income students. However, the percentage of low- income group wanting to become scientists is only 3% less than the high-income group and 4% less than the middle-income group.

The levels of mothers' education is also related to the attitude toward scientists. The students whose mothers did not attend high school have a less favorable attitude than those whose mothers completed more formal education.

Science Itself

What kind of problems should science investigate? What are the consequences of scientific endeavors? These are the topics of the questions about science.

The students are divided on the issues of whether science should be applied to such things as religion and morals, the understanding and control of human behavior, and segregation and poverty.

Over 60% of the sample **doesn't** believe that science is immoral because of possible contradictions with religious teachings. A large majority (78%) think that "many things can never be understood by the human mind." Slightly over half think that scientific laws of human behavior can never be established.

The responses to the foregoing questions would seem to indicate that youth thinks science cannot solve all of mankind's problems. Nine out of ten, though, agree that science has aided the welfare of humanity by reducing ignorance and disease. And the goal of science is to benefit mankind, say 90% of the students.

Scientific training leads to good citizenship, say three-fourths of the teenagers. However, the immoral use of scientific findings is responsible for the widespread cruelty of man according to 38% of the youth.

(Single copies of "Poll No. 50" are available. Remit $1.00 direct to Public Opinion Panel, Div. of Educational Reference, Purdue University, Lafayette, Indiana.) ◆

But there's a silver lining . . .

Michigan State University's Science and Mathematics Teaching Center — organized in the pre-Sputnik era — stimulates interest in scientific study among Michigan young people with the following programs:

- Two-week summer conference for high school sophomores and juniors that will permit them to see and talk to scientists and mathematicians at work.
- Summer institute for community junior college science and mathematics teachers.
- School-and-industry science fairs in several Michigan counties.

Dr. Frederic B. Dutton, science center head, warns that bright students should not be "shanghaied" into a science career. "A sensible balance must be maintained between scientific and non-scientific learning," according to Dr. Dutton.

Joint industry-education goal, he feels, is to help young people discover early in their school careers if "they find science and mathematics exciting and intriguing and want to learn more, or . . . these fields are not for them."

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NEW LITERATURE

continued from page 36

clude instantaneous heaters, oil preheaters, heating convertors, air heating coils. Slow-heating exchangers include storage water heaters, oil storage tanks, plating tanks, kilns, and ovens.

(Bulletin 1012 is available from Spence Engineering Co., Inc., Walden, N. Y.)
Circle 1738 opposite last page.

Compressor check valves control hammer, surge

New vacuum-controlled gas-air check valve is designed for gas and air reciprocating compressors not having automatic unloaders. Controls compressor surge and hammer.

Valve operates silently except when discharge valves leak — then it pulsates with compressor stroke to sound alarm. Valves are 1½ to 10 inches for 125 to 2500 psi.

(Data Sheet WH-754 on gas-air check valve is available from The Williams Gauge Co., Inc., 2 Gateway Center, Pittsburgh 22, Pa.)
Circle 1739 opposite last page.

For more information on items reported in the New Literature section, circle corresponding numbers on reader service card opposite this page.

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Expert advice offered on such problems as raw water supply, power plant water needs, cooling towers and ponds, water treating equipment, how to test and control water.

(Booklet on Dearborn Consulting Service may be obtained from Dearborn Chemical Co., Merchandise Mart Plaza, Chicago 54, Ill.)
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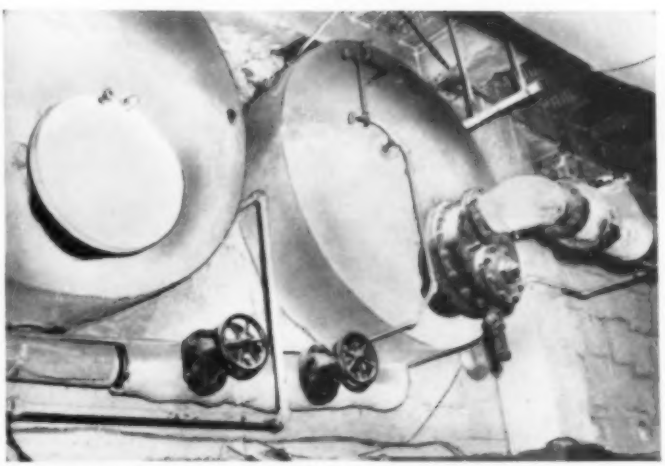

THE PROBLEM: *How to economically replace two leaking hot water tanks.*

THE SOLUTION: *Old tanks were capped off and a compact B&G Type "WU" Instantaneous Water Heater connected to the boiler.*

Reg. U.S. Pat. Off.

The photos here tell a significant story to plant superintendents and operating engineers. The "Problem" picture shows two old-fashioned hot water storage tanks, requiring replacement because of leakage... the "Solution" picture how the tanks were replaced with a modern B&G Instantaneous "WU" Heater.

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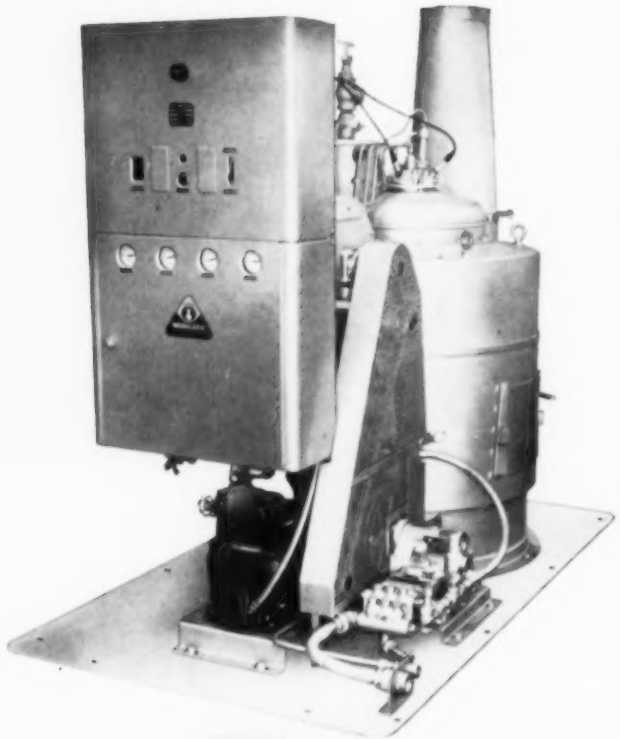

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